Taking the Long, Holistic, and Intersectional View to Women's Wellbeing

NEHA KUMAR, Georgia Institute of Technology
NAVEENA KARUSALA, University of Washington
AZRA ISMAIL, Georgia Institute of Technology
ANUPRIYA TULI, Indraprastha Institute of Information Technology

In this article, we present 6 cases (contained in 13 studies) variously connected with women's health in a range of Indian contexts. Analyzing these cases, we highlight that "women's health" is inextricably linked with extrinsic factors that also need addressing, to propose a broadened focus of "women's wellbeing," as defined through the lens of Martha Nussbaum's *central human capabilities*. Drawing again on our cases, we discuss the importance of taking a long, holistic, and intersectional view to women's wellbeing. Consolidating lessons learned across studies, we emphasize the potential of framing challenges around women's health as learning problems, rather than problems of information access alone. Leveraging this perspective, we propose the use of *design-based implementation research* as a potential approach in identified learning ecologies, given its emphasis on long-term engagement with multiple stakeholders in the learning process. Although the empirical research we draw from took place in various Indian contexts, we conclude by arguing that key contextual characteristics may translate to other cultures and geographies as well.

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CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**;

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1 INTRODUCTION

There has been a growing push in the field of human–computer interaction (HCI) towards designing technologies that might positively impact women's health, such as technologies that support women in practising maternal, sexual, and reproductive health, or other aspects of physical health. This has occurred alongside increased awareness of the need to address women's concerns in general, which have otherwise been unattended to along many dimensions. Even as HCI increasingly turns its attention to concerns around women's health, with frameworks such as that of feminist

HCI [12] to assist and enable interested researchers along the way, significant prior research also highlights that a holistic approach to women's wellbeing is needed, with inquiry into not just health aspects, but other aspects as well, such as safety (e.g., [3, 27, 28, 51]). This is especially true when we step outside of elite western settings to culturally distinct and diverse ecologies, where it is not sufficient to simply bring technologies into existence—women users must also be empowered to influence the design of these technologies, adopt them, engage with them on their terms, and use them over time [90].

Our goal in this article is to consolidate lessons derived from a set of women-centered projects (or cases) led by the authors. These cases highlight how various extrinsic factors are inextricably linked with health outcomes. Based on our research, we propose that HCI's engagement with women's health be expanded to include general wellbeing. Nussbaum's conceptualization of *central capabilities* offers us a starting point for dialogue on this topic [84]. The cases we present bring attention to several of these capabilities, and offer an understanding of how HCI could further enrich its contributions towards women's overall wellbeing, particularly when these women belong to diverse backgrounds. Each of the authors has devoted several years to ethnographic, design-based, and/or participatory action research with a focus on diverse aspects of women's health and wellbeing. Situating ourselves against the cultural backdrop of rural and urban Indian community settings, we draw on our long-term investigations into women's wellbeing—both online and offline, physical health, work practices and livelihoods, among others (e.g., [42, 46, 51, 64, 65, 118, 130]).

In each of the cases, we conceptualize women's wellbeing with a view towards the central capabilities. We then lay out challenges such as barriers to adoption, mismatched perceptions around technology adoption and use, the presence of cultural taboos, among others. We frame these challenges in terms of *learning* problems rather than *access* problems, where receptivity to information may be lacking on the part of particular stakeholders. We then discuss the insights gleaned from a combined analysis of our cases, to push for HCI to consider a long, holistic, and intersectional view to wellbeing, including as well opportunities for further exploration. Finally, we adapt the *design-based implementation research* (DBIR) framework [69] to studying women's wellbeing in HCI. DBIR was developed by education researchers to address the challenges of sustaining and scaling up research-based innovations in learning environments. DBIR emphasizes design and research focused on the issues of broader implementation. We demonstrate the value of DBIR by discussing how the learning problems we describe in this article might be mitigated through application of the DBIR framework. We argue that the adoption of a learning-oriented approach is critical if HCI is to take a long, holistic, and intersectional view to women's wellbeing.

Our research contributions through this meta analysis are multiple. First, we argue for a shift from focusing on women's health[1] to wellbeing. Second, we recommend taking a long, intersectional, and holistic view to women's wellbeing. Finally, we suggest a learning focus and outline the role that DBIR could play in future undertakings around women's wellbeing. Our contributions, while adding to a growing body of work within HCI and women's health in general, aim to bolster related efforts within the HCI for Development (HCI4D) community that are at the intersection of HCI and women's wellbeing, and could potentially benefit from the lenses we employ in our article.

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[1]We note that for our participants, who were all cis women, gender was aligned with female health concerns around menstruation, pregnancy, and other bodily processes. We discuss our participants' experiences in this article, but we recognize that gender and sex are not always aligned in this way.

2 RELATED WORK

We situate our cases in prior work, starting with summarizing research on women's health in HCI. We then draw attention to the cultural situatedness of women's health and wellbeing. Next, we summarize Nussbaum's list of central capabilities [84] and its relation to women's wellbeing. Finally, we describe the tendency of current HCI interventions in women's health to address information poverty, highlighting the need to go beyond and target learning.

2.1 Women's Health in HCI

A rich and growing body of literature in HCI critically investigates women's health, women's bodily experiences, and women's relationships with their bodies. An initial workshop at CHI 2017 led by Balaam et al. around hacking women's health brought together researchers in this field [9]. Since then, the area has rapidly grown to take a broader view of women's health, including taboo topics such as menopause, menstruation, breastfeeding, and intimate care [5, 8, 11, 47, 68, 118, 126]. A significant portion of this research employs and contributes to feminist theory, which lends itself well to the topic of women's health and wellbeing. Bardzell's introduction of the feminist HCI framework [12] allows HCI research to examine power imbalances, and how these might impact technology design, adoption, and use (e.g., [53, 60, 118]). This social justice focus is appropriate, given that women's bodies and their concerns have historically been taboo, impacting women's progress in different spheres of life [5, 111]. However, much HCI research in this space tends to come from or examine a certain demographic (cisgendered, white, middle or high-income women) and rarely takes into account broader systems of oppression and intersections with other identities such as class, race, and more [3, 29, 45, 103, 111, 130]. Aligned with contemporary feminist movements in academic and non-academic circles, more HCI researchers are taking intersectional approaches to designing for women's health [94].

While some literature sets a broader scope for health-related subfields in HCI (e.g., [37, 48]), there is little work on what constitutes wellbeing. Outside HCI, wellbeing has been a focal point in global health, reflected in Goal 3 (Good Health and Wellbeing) of the United Nations Sustainable Development Goals (SDGs) [6]. The World Health Organization (WHO) recognizes that *social determinants*, or the conditions in which people are born, grow, live, work, and age, play a key role in health and wellbeing [87]. The WHO further states: "These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries" [87]. An emerging body of HCI research in the Global South speaks to these aspects. This work grapples with deeply patriarchal societal and organizational structures, and intersections such as caste, class, and religion that impact women's wellbeing. Typically driven by researchers from and/or living in the Global South, this work has built on postcolonial and intersectional orientations to feminist HCI [43, 45, 63, 104, 130].

We suggest that studies in the Global South have much to offer to HCI's collective understanding of women's health and wellbeing. In this article, we will emphasize taking a long, holistic, and intersectional view to research and interventions in this space. A long view requires studying women's wellbeing over multiple timeframes, changing contexts, and life stages. A holistic view entails taking an ecological perspective on which stakeholders and infrastructures affect women's wellbeing. An intersectional analysis requires understanding the different and multiple forms of marginalization women may experience on account of their identity, and how they uniquely shape aspects of their struggles towards wellbeing [24].

2.2 Women's Health and Wellbeing in the Global South

Among women's health research in the Global South, prior studies have primarily focused on maternal and child care [7, 45, 91, 95, 112], and sexual health [79, 118]. Many studies, however, have looked beyond physical health towards women's safety and privacy [2, 3, 51, 99, 100], financial health [13, 42], social and mental wellbeing [45, 111], and workplace culture [45, 113] in diverse contexts. These have been conducted in both rural and urban settings, with economically privileged as well as the poorest sections of society, and engage with multiple languages and local dialects. They include populations of different ages, religions, castes, and cultures. Frequently taking an action research and/or social justice approach, these studies show how women's health and wellbeing are tied to cultural values, and impacted by patriarchal societal and organizational structures.

Maternal and child care presents one case where the roles of digital literacies, stakeholder attitudes, cultural norms, institutional and familial structures, and more have been well documented [7, 45, 60, 89, 95, 112]. Many countries in the Global South have employed women frontline health workers to deliver last mile health care, particularly maternal and child care. Several technology interventions support the daily work of health workers [77, 95], and increasingly engage with human infrastructures in order to be truly effective [13, 26, 64, 77, 91, 92]. Frontline health workers themselves have also presented opportunities for design as low-income, middle-aged women at the bottom of the hierarchical health-care system, resisting patriarchal structures at home and at work on a daily basis [60, 64, 95, 121]. For example, studies have highlighted how women frontline health workers in India are denied opportunities for skilled work and economic mobility, which impacts the quality of their work and adds to their physical and emotional labor [45, 46]. Though these workers typically belong to low-income groups, other non-health research on middle- and upper-class Indian women working in the technology sector has similarly uncovered how familial pressures and workplace discrimination result in women's exit from the workplace [113].

Another relevant case is research on women safety [3, 4, 39, 51, 82, 99, 114, 121]. HCI researchers have also studied taboo health topics such as menstrual health education (MHE) and women living with human immunodeficiency virus (HIV), investigating the role of societal structures and cultural norms in accessing health care and health information [47, 79, 108, 118]. We contribute to this rich literature by consolidating lessons for women's wellbeing more broadly.

2.3 The Capability Approach

Given the diversity and complexity of literature on women's health, there is a need to consolidate, unpack, and expand HCI's understanding of women's wellbeing. This forms the focus of our article. We find that Nussbaum's research on the capabilities approach and women's empowerment [83, 84] offers us a starting point to further examine feminist work focused on the Global South. Both Sen and Nussbaum have critiqued the popular development economics discourse and its limited success and narrow focus on standard of living [84, 105, 106]. Sen argues that the focus should be on wellbeing—a broader concept that takes into account economic *and* social welfare [106]. He proposes an alternative pathway for measuring human development, *the capability approach*, that goes beyond just evaluating the means available to a people, instead considering what they are capable of doing with these means [105, 106]. This approach has also received attention in the field of Information and Communication Technologies and Development [55].

Though Sen preferred to leave the defining of capabilities to each society, Nussbaum argues that a minimum threshold is necessary so that citizens are able to demand rights from their government [84]. Nussbaum grounds her framework in the lived realities of women who are marginalized in the Global South. She argues that women in developing contexts have suffered acute capability

failure, where unequal social and political circumstances leave them more vulnerable, and less able to lead dignified lives at the same level as men [83]. At the same time, Nussbaum points out that "inequalities in health care and nutrition are ubiquitous in the United States" and are not limited to the South. Nussbaum's list of ten central human capabilities includes (1) life, (2) bodily health, and (3) bodily integrity, which are more directly associated with physical health [84]. Then there are (4) senses, imagination, and thought, and (5) emotions, which might be linked with women's freedom to express themselves without fear and anxiety. The remaining are (6) practical reason, (7) affiliation, (8) other species, (9) play, and (10) control over one's environment.

Nussbaum's list has attracted significant criticism for creating a list of reductionist, universal values that appear to be linked to western liberal notions of human dignity despite claims of being cross-cultural [93, 109]. Others have stressed the need for a more comprehensive framework that outlines how capabilities should be chosen and ordered, and their relation to justice, equality, and rights [109]. James also highlights the tensions between various capabilities in the list [109]. Despite these concerns, Nussbaum's list offers a productive starting point for understanding women's wellbeing in the Global South because it goes beyond economics discourse and also requires attention to women's specific contexts that might support or inhibit the capabilities [98]. Our cases illustrate how designing for women's wellbeing may require us to target several of the central capabilities defined by Nussbaum, though there may be others.

We also take inspiration from prior work that has critically engaged with this framework, such as to examine and critique the SDGs [6, 40]. Oosterlaken has proposed that the capability approach is relevant to the design of technology for development [85, 86]. A capability approach to healthcare has also been suggested before [67], and has recently been used to assess women's health in Global South contexts [110]. We offer an empirical approach to this body of work, drawing on lessons from six case studies to extend HCI's understanding of women's *wellbeing* in the Global South, with a view towards the central capabilities.

2.4 From Information Access to Learning

Many interventions in HCI4D that variously target women's interests focus on addressing information poverty by providing access to critical content around health, education, financial, and other services. Prior health interventions have delivered information in the form of videos and mobile applications, frequently leveraging frontline health workers who use projectors or mobile phones to disseminate information (e.g., [64, 77, 95, 123]). In the case of women's safety as well, emergency safety features or storytelling forums on mobiles have attempted to provide women with easier ways to find help or share their experiences with safety (e.g., [3, 27]), but some of these have documented poor uptake (e.g., [3]) or limited impact (e.g., [51]).

In their research on barriers to information access and disclosure for women with HIV in India, Natarajan and Parikh argue for the need to move "from information standardization and dissemination to systems that enhance access and use through personalization, reflection, engagement, trust and usability of information" [79]. There is not only a need to bring information to people, but also to enable underlying skills and infrastructures so that information can be *received* and acted upon. In short, we frame this as a *learning problem*. For women's health in particular and wellbeing more broadly, this translates to not just informing women about their rights and how to take care of their bodies, but providing them the scaffolding needed to be able to act on this information. We argue that treating this as a learning problem is the first step in creating spaces in which we can start working and designing towards increasing women's agency and ultimately their wellbeing.

Vashistha et al. have previously taken an approach to target learning, by using mixed methods to evaluate the impact of localization of videos around maternal and child health on knowledge

gains and receptivity among rural women [123]. Similar approaches have been taken in traditional learning environments such as schools. For instance, Sorcar et al. designed, deployed, and tested a curriculum on sexual health education (a taboo topic in many countries in the Global South and North) that included a series of highly localized videos, taking a learning sciences approach [107, 108]. For learning in informal environments, *situated learning* may be an appropriate framework to examine. Proposed by Lave and Wenger, it states that "learning is fundamentally a social process" and that it takes place as a result of engaging in an activity in the context in which it normally occurs [66]. Situated learning has proved to be particularly relevant in the case of community health workers who not only need to provide maternal and child care and primary health services (for which they receive training), but also motivate communities to adopt healthy practices, and nurture and maintain good relationships with community members (typically learned through experience) (e.g., [46, 95]). Though informal learning has been a key area of interest in HCI4D for years (e.g., [58]), it has been underexplored in the context of health [31].

Among learning science approaches, DBIR offers HCI a pragmatic, iterative approach that relates research and practice, each continually informing the other [32]. DBIR was initially developed for facilitating the design of interventions in classrooms, by taking a practice approach, and indeed, uptake of this framework has largely been in formal classroom environments (e.g., [20, 22, 23, 56, 70, 88]). Broadly speaking, it entails a focus on *(1)* an ecological view of stakeholders, *(2)* sustained interventions, *(3)* design-based research, and *(4)* iterative design [32]. Its roots lie in evaluation research, community-based participatory research, design-based research, and implementation research [32], which have been employed extensively in HCI research, in general. Building on Kumar and Dell's proposal [61], we suggest that DBIR could be extended to formal and informal learning contexts that target women's wellbeing. DBIR could facilitate an approach to designing interventions that take a long, holistic, and intersectional view by looking at learning over time, collaborating across stakeholders and aligning with their goals, and understanding stakeholders' cultural, demographic, and other specificities.

3 METHODOLOGY

In the following, we describe 13 studies conducted by the authors, consolidated into 6 cases. Each case focuses on multiple aspects of women's wellbeing, derived from Nussbaum's *central capabilities* [84], which we make explicit, and related technological engagements. While some cases only include a single published study, others include three or five; thus, we draw on significantly more years of data for some cases than for others. Any insights presented in these cases are drawn from individual coding exercises and inductive analyses previously conducted, peer-reviewed, and published, now curated through the lens of learning problems. All studies were approved by the institutional review boards at our respective universities and collaborating institutions.

3.1 Case 1: Women's Safety in Public Spaces

Case 1 presents findings from a qualitative inquiry that we conducted on women's safety—as perceived—in urban spaces of New Delhi. We revisited the data we had collected in 2016 via 17 semi-structured interviews with women in New Delhi, aiming to understand their opinions on the Indian Government's panic button mandate [131] and experiences with personal safety in public spaces. As outlined in our prior publication [51], we recruited participants using a combination of purposive and snowball sampling [38, 117]. Questions we asked covered participants' demographics, everyday commutes, views on the panic button, conceptualizations of and experiences with safety, and technology use for personal safety. We also conducted a survey asking similar questions, which garnered 30 responses from male and female participants who lived in several different cities, including New Delhi.

We coded all interview and survey data using interpretive qualitative analysis [75]. We conducted open coding by going through each response to questions and selecting concepts. Examples of the codes we created included "*I talk to my parents while riding in autos*" and "*I avoid walking alone in dark places.*" We further iterated on coding to arrive at categories such as "*social contact: calling or messaging family*" or "*locations: avoiding isolated areas.*" These categories were then consolidated into factors that impacted women's sense of safety. For the purposes of this article, we analyzed these findings through the lens of learning opportunities.

3.2 Case 2: Privacy and Participation on Social Media

Case 2 presents a summary of our examination of women's participation on social media, and the negotiations they are subject to on account of their gender [50]. Data collection for this study took place through 2018 in the cities of Bangalore and New Delhi. Our participants included early adopters (among Indian women) of internet and social media, who also had relatively greater privilege operating in technology-rich spaces. We conducted semi-structured interviews with 32 women, all 20–34 years old. These women had varying digital literacies, and were a diverse group, coming from the 11 states of Gujarat, Punjab, Tamil Nadu, Karnataka, Andhra Pradesh, Kerala, Uttar Pradesh (UP), Rajasthan, West Bengal, Haryana, and Madhya Pradesh. Interviews covered participants' use of different social media platforms. Questions regarding privacy led to discussions around other technologies, such as Ola/Uber, Truecaller, and Aadhaar. We recruited participants using a combination of snowball and purposive sampling [38, 117].

We transcribed and translated our data to English, before subjecting it to thematic analysis [16]. We went through the data and coded it; lines like "*I showed my mother that see, everyone is putting their pictures and I will do that too*" and "*like earlier I used to put decent pictures in jeans and proper top on Facebook but eventually I stopped giving a damn about all this*" were mapped under broader themes such as "women's cultural appropriation of social media," for example. We revisited these themes and viewed them through the lens of learning for this article.

3.3 Case 3: Menstrual Health Education (Offline and Online)

Case 3 investigates online and offline practices around MHE in India, for which we revisited our data collected from two studies. In the first study conducted in New Delhi in 2017 [119], we used a combination of methods to understand how individuals encounter and disseminate MHE in professional and everyday settings. We first conducted semantical content analysis [35, 36, 57] of MHE training materials in use, to examine their coverage of the topic. We then conducted an in-depth online survey of 391 adults (across genders), 52 semi-structured interviews, and two focus groups, all targeting adults, parents, teachers, social workers, and healthcare professionals. Survey and interview questions were focused on sources of knowledge around menstruation, the suitable age for imparting MHE, associated taboos, and resulting stigma. We subjected the qualitative data to thematic analysis [16]. Sample codes included "*misinformation,*" "*no prior information,*" and "*religious practices and beliefs.*" The rest of the data were analyzed by calculating percentages and cross-tabulation [57]. The data from different methods were duly corroborated and validated using appropriate triangulation to derive inferences.

In a second study in 2017–2018, we conducted qualitative research to understand how individuals seek, receive, and disseminate menstrual health information in online spaces [118]. We studied the case of Menstrupedia [74]—a digital platform that has been designed with the intention of helping Indian girls and women in learning about and managing their periods. As outlined in our study [118], we analyzed data from the question and answer (Q&A) forum, comic, and information section of the website. We also carried out think-aloud [19] comic reading sessions with 20 young adults (across genders) to understand their response to Menstrupedia's approach to MHE,

and conducted thematic analysis [16]. From the website's Q&A section, we collected the title, content, date of post, number of views, number of responses, author name, and tags for each question posted before January 31, 2018. We then prepared a codebook to deductively code the collected data (first for question *topic* followed by question *type*). The sample codes included "*education,*" "*hygiene and management,*" "*myths and taboo,*" among others. We used an altered version of this codebook for analyzing the platform's comic (Hindi and English) and information sections.

In both studies, participants were recruited using a combination of snowball and purposive sampling [38, 117]. The interviews and interaction sessions were audio-recorded and later transcribed and translated for analysis. We used Bardzell's Feminist HCI framework [12] for analysis in both our studies. In the first study, the framework helped in analyzing our findings, while in the second, we used it for both research design and data analysis. In adapting these analyses for our current article, we focused our attention on learning challenges (particularly stigma) and opportunities.

3.4 Case 4: Community-Led Video Education for Maternal Health

Case 4 looks at *Projecting Health* (PH)—a maternal health project in rural India—for which we have data collected from 2012 to 2018. PH was deployed with the help of a complex ecology of actors in two UP districts (Raebareli and Fatehpur) and 150 villages, targeting a population of about 200,000 people. In over 6 years, 110 short films were produced and at least 15,210 group disseminations were organized. Many different stakeholders—including researchers, global health organizations, community-based organizations, community health workers (widely known in India as ASHAs or Accredited Social Health Activists), and other community members, among others—were involved throughout. PH took a participatory action research approach [73], where volumes of data were collected using numerous methods (interviews, focus groups, surveys, and participant observations), and across multiple studies [59, 60, 64, 122, 123].

Although our analysis in this article is shaped by our overall long-term engagement with this project, and the data we have is voluminous, we focus here on the fieldwork conducted with and through ASHAs and the community-based organizations who were responsible for the implementation of the project on the ground. This includes details on at least 30 group disseminations, organized across roughly 15 weeks spent in the field, as well as interviews and focus group discussions with ASHAs, mothers, and the field staff throughout this time. All behind-the-scenes video production processes were duly documented. Taken together, we were able to triangulate our data and somewhat mitigate the impact of participant response bias, which was not insignificant, as documented in prior work [59].

Our prior studies have analyzed *(1)* the community-orchestrated information flows that make up PH [64], *(2)* the relevance of mobile phones in this ecology that led to a redesign of PH [60], *(3)* the disconnect in how women use mobile phones and how they are perceived to use them by their male counterparts [59], *(4)* the roles played by different community actors in shaping information flows through their communities [122], and *(5)* the importance (or not) of translating all content to local dialects in the community-created videos [123]. In this article, we revisit the foundational elements of PH that were focused on community-led video education as well as other dimensions of learning.

3.5 Case 5: Work Practices of Community Health Workers

We have been studying the role of community health workers (ASHAs) in urban slum communities of Delhi since 2016, with the goal of understanding how technology might assist them in their day-to-day workflows. This work has contributed to three published studies; the first entailed an investigation of partial knowledges that inhibit care-seeking behaviors as well as care delivery [44], the second focused on the data collection practices of the ASHAs to highlight the disconnect

between the top-down expectations and ground-up realities [45], while the third examined the online experiences of the ASHAs, which we draw from here [46].

We conducted semi-structured interviews with 20 ASHAs several times in 2016–2018. We also conducted participant observation online (on Facebook and WhatsApp) and offline (through interactions during interviews). In addition, we observed 7 all-ASHA WhatsApp groups over 7 months in 2018; 4 groups had 2 participants, while the rest had 3, 5, and 15 participants, respectively. Offline participant observations were conducted by shadowing ASHAs during their visits to households over 6 days. Many of the household members visited were low-literate (as they proclaimed themselves to be). Online experiences of the ASHAs were enabled by the newly affordable Reliance Jio internet [41], and we conducted content analysis of promotional offers, advertisements, and news articles on Jio from 2016 to 2018. We also interviewed five mobile shop owners to learn from their experience regarding prevalent mobile practices in the area.

We had at least two interactions with all ASHAs (more in some cases). Interview sessions were 45–60 minutes long and questions focused on their current and past use of mobile phones and the internet for work, household tasks, and leisure. All interactions and data collection took place in Hindi (to be translated later). We also had field notes, audio recordings, and photographs. All data were collectively analyzed using the inductive process outlined by Merriam [75]. We conducted several rounds of open coding, focusing on findings that concerned the mobile and internet practices of the ASHAs. The first round of coding closely followed the text. The next round of coding was more high-level and resulted in codes such as "*use of WhatsApp for work*," "*social media to connect with family*," and "*infrastructural barriers to internet use*." Subsequent rounds of coding combined several codes to surface larger themes such as "*challenging gender norms in the household*" and "*power dynamics with doctors*." The emergent themes highlighted the ASHAs' use of mobile phones and the internet to navigate and increase their participation as peripheral members of various communities of practice [127], leading us to use the lenses of intersectionality [62, 104] and legitimate peripheral participation [66] in our analysis, as we elaborate on in this article.

3.6 Case 6: Aspirations of Financial Independence

Case 6 provides a longitudinal view of the aspirations of young women. Our research took place in an after-school center that was located in Baruipur, approximately 25 kilometers from Kolkata, capital city of the Indian state of West Bengal. The non-profit that had set up the center, established over 40 years ago, aims to provide education and training for uplifting and empowering female youth in this region. These women are vulnerable to sex trafficking, prevalent in this region, which also forces many women into prostitution and encourages early marriage of daughters to circumvent the risk of trafficking. The threat posed by trafficking limits the freedom of movement that the women have; they tend to feel unsafe venturing out of their villages after dusk. Lack of safety and restricted mobilities also end up shaping potential futures of the young women, which was our topic of exploration.

Our study took place within the premises of the after-school center, which had 1 coordinator, 4 teachers, 4 salaried administrative staff, and more than 350 girls, with 150 of them in grades 11 and 12. These girls are given regular orientation on issues such as adolescent health, child marriage, teen pregnancy, and domestic violence. They are all taught children's rights; those older than 11 are taught adolescents' rights as well. Over 18 months, we visited the center 4 times, separated by 6 months each. We conducted 35 hours of participant observation at the center and nearby villages. Our research participants included various stakeholders in this ecosystem. We conducted semi-structured interviews with 26 participants—3 teachers, 3 staff members, 10 mothers (no fathers were available for interviews), and 10 12th-graders. In addition, we did group

interviews with 40 other students. The goal of all data collection was to gain a deeper insight into the day-to-day activities and challenges that the (female) students engaged with and aspired to overcome, to uncover the role that technology might play in such contexts.

All data were collected in Bengali (the local language). We recorded, transcribed, and translated the interviews before analyzing them inductively and in conjunction with our field notes. The process of analysis was iterative, and we developed codes that we refined repeatedly in order to arrive at the analysis we present below, following the guidelines offered by Merriam [75]. We began with coding at the sentence level and iterated multiple times. Different stakeholders—the center, students, mothers—all aspired to (hopefully) financially independent futures for the girls. We used codes such as "*short-term aspirations*," "*long-term aspirations*," "*social avenues*," and "*technological avenues*" to better understand perceptions of how these futures might be achieved. Our focus in the end was on the kinds of learning that the girls had available to them, or were keen to avail.

3.7 Positionality

All of the above research was carried out from a feminist perspective and with an emancipatory mindset, aiming to explore how technology design, adoption, and use might prioritize the needs and interests of women, but also develop an understanding of how these needs are embedded in complex ecologies. As indicated above, each of the projects was led by one of the authors over the past 5 years. All of the authors identify as cis-gender women and are of Indian origin; one of us lives in India, while the rest frequently cross borders between the USA and India. We are all strong advocates of social equity and justice, colored by the desire to work towards a world that offers equal opportunities across genders. Given our commitment to social change that can create a space for women and girls to find themselves empowered, as demonstrated by our recent work on bringing shades of feminism into human-centered computing [78], our representation of our subjects and field sites may be accordingly biased. We are also shaped by the time we have spent in the United States; this has colored our understanding of desirable gender norms with Western shades of feminism (for example, an emphasis on the individual over the collective). We relied on a process of analysis that was heavily grounded in the raw data and coding, along with self-reflexivity during discussions of the data, to keep this mindset in check.

4 CASE STUDIES

The following case studies draw on our research on women's experiences across demographics in rural and urban Indian settings—relating to safety in public spaces, privacy and participation on social media, MHE, community-led videos for maternal health, work practices of community health workers, and aspirations of financial independence. In each of these cases, we highlight the importance of "*taking the long, holistic, and intersectional view to women's wellbeing.*" Again, we define wellbeing in terms of the *central capabilities* laid out by Nussbaum, a major proponent of the Capabilities Approach along with Sen [83, 84, 105]. Throughout the cases, we highlight learning challenges and opportunities to motivate a recasting of the barriers to women's wellbeing as learning problems.

4.1 Women's Safety in Public Spaces

The construction of urban spaces around the world is often centered around men as the default navigators [90]. This is directly related to Nussbaum's central capability of *bodily integrity* [84], as several studies show that women consistently feel more unsafe and experience more sexual harassment in public spaces, and the design of such spaces only tends to exacerbate these concerns (e.g., [71, 120]). Bodily integrity also ties to *bodily health*—in addition to the physical and psychological harm that comes from experiences of sexual harassment [83, 84], worrying about safety

is an environmental stressor [15], and restricted mobility has implications for women's freedom to access health and educational resources [120]. The HCI community has largely looked at how women use technology to afford themselves a sense of safety despite this built-in bias and has proposed the design of technologies to support these behaviors (e.g., [3, 4, 14, 102]). However, a more holistic take on women's safety reveals how we might go beyond increasing a personal sense of safety to engaging a greater number of stakeholders in supporting women's mobility—this reframes the issue as a learning problem where we might support multiple actors in understanding women's experiences with safety.

In our research on women's safety in New Delhi, we identified six factors that affected women's sense of safety—the design of urban spaces, media discourse, social actors such as parents and peers, law enforcement, technology, and women's own embodied sense of safety [51]. The Indian Government had recently mandated the installation of a panic button (meant to alert law enforcement upon activation) on all newly manufactured mobile phones [131]. We found that this mandate did not demonstrate thoughtful consideration of the six factors, highlighting the many ways learning was *not* taking place in the context of women's safety. For example, the panic button did not align with the types of sexual harassment that women most often faced due to the design of public spaces. Overcrowded spaces or dark and isolated areas in the city could both exacerbate the most common issues our participants faced, like staring, teasing, or groping, but these were not events that they would necessarily call the police for, preferring to ignore or confront the perpetrator themselves.

Participants did not prefer calling law enforcement even in times of greater emergency, mirroring how many efforts to make urban spaces safer for women rarely reflect what actually makes women feel safer [72]. First, participants generally preferred to invest their energies into precautionary methods, such as coming home by a certain time or avoiding isolated areas. Second, if there was an emergency, participants would rather call parents or friends for help, citing the lack of responsiveness of law enforcement, misunderstanding of women's safety issues, and even their complicity in making women feel unsafe. However, we found that women's sense of safety was often most supported when they felt they did not need to think about it in the first place. Women described their experiences living in safer areas within New Delhi or in other Indian cities, noting how norms like familiar security guards patrolling neighborhoods, policies against alcohol consumption, being able to call the police for late night transportation, or simply seeing women using the space in the first place could snowball, making spaces welcoming for even more women.

Participants felt well-versed in taking precautions when needed, but other actors were not so confident in their judgment. Participants noted how they would share their location during cab rides or follow curfews for their parents' sake, even if participants were not personally concerned for themselves. One participant noted how media coverage of sexual harassment was one reason her mother insisted on precautions, which became an unfair burden: "*Sometimes it's just annoying...I'm not in a very restricted house but yeah, I would definitely get a call from my mom if I'm not home by 10:00, 10:30...I'm OK with it, but my mother is not OK with it.*" This dynamic was also evident in participants' perceptions of using the panic button. Participants were concerned about issues like victim-blaming or unnecessary questioning by law enforcement if they were to call for help, the root of which is a mistrust of women's accounts of safety and their right to mobility. Additionally, participants were worried that this perception would be further fueled if they did indeed press the panic button when there was no "real" threat, despite the very real concerns they may have had when pressing the button in the first place.

A holistic view of women's safety reveals the learning problem in supporting women's mobility. We found that actors such as parents (including mothers, who may have been most intimately aware of and subject to the need to preserve one's safety), the media, or law enforcement

superimpose their perspectives upon women's subjective experiences, rendering ineffective interventions that ignore these power relations. Further, if women's experiences are not understood or trusted, it may be even less likely that appropriate interventions garner political will, recreating systems like the panic button. We see such indifference in other dimensions of wellbeing, such as women's physical pain being underestimated [54], or women's safety being overlooked in traditionally "masculine" domains like the workplace [21]. This motivates a *long* view, where we might take on the challenge of engaging with deep-seated presumptions around women's experiences. For learning to happen among multiple actors, diverse forms of information might be needed. Family might see the compatibility between safety and mobility over time through interactions with their children or their peers, while law enforcement might require sensitivity training and methods of accountability that reinforce appropriate police response. Meanwhile, improved planning of public spaces might require the decision to collect data on a city-wide level on women's mobility.

Our study sample consisted of middle- and high-income women in New Delhi, but fully considering the learning problem also requires having an intersectional understanding of women's safety. Participants already noted that different cities afforded different experiences with safety. Rural areas might bring a host of different considerations, such as the need to travel longer distances, often by foot, in light of fewer public transport options and expectations around how women should travel [120]. Another intersection might be income. For instance, lower income women often rely more on walking or public transport and public transport may be prohibitively expensive for some [71]. Just as safety is situated, so is the learning problem. Large-scale data on safety might not just be disaggregated by gender, but also by income or other salient social divisions such as caste. Supporting communication among women and their community (for example, about the status of their safety) might also involve considering diverse family structures and the expectations different family members have around women's mobility.

The panic button was supposedly mandated in order to serve women's sense of safety across India. However, we found that there were many complications its design did not consider, revealing the need for a better understanding of women's safety at a public policy level. At the individual level, we found that women's mobility was limited not just because of threats of harm, but also because of other actors who had presumptions around women's safety. This points to further opportunities for understanding and trusting women's experiences. Here, we see that women's burden of constantly thinking about mobility could potentially be alleviated through multiple stakeholders learning about women's intersectional experiences with safety.

4.2 Privacy and Participation on Social Media

HCI has increasingly been exploring women's social media use, bringing attention to concerns around safety and online harassment (e.g., [1, 99, 121]). Studies in deeply patriarchal contexts in the Global South describe the especially high stakes women face in maintaining their privacy online [1, 99]. For instance, having one's profile picture used for synthetic porn or profile impersonation could severely damage collective perceptions of women's modesty or honor [99]. As per Nussbaum's central capability of *senses, imagination, and thought*, ideally, women could freely consume and share content on social media without harm, but this has not been the case. We studied urban Indian women's appropriation of social media, allowing us to take a process-oriented perspective to how women handle particular restrictions to their social media use. This case allows us to frame privacy and participation on social media as a learning problem where women discover tools (cultural or technological) over time that help them achieve freedom of expression.

Many of our participants reported how setting up and using social media required convincing family members, such as parents or husbands, that it is appropriate to use. Many participants said they wanted to use social media to connect with friends, share content, or play games, but family

members deemed it inappropriate, citing reasons such as it being unsafe to post information or pictures of oneself online, or no other women in the family having social media. However, participants reported going ahead and creating social media anyway, also leveraging certain cultural tools to convince family over time that social media is harmless. Participants reported showing parents how nothing happens if one posts pictures of themselves/their face online. Some also negotiated the use of certain features, such as being tagged in pictures, even if they could not post pictures themselves. Eventually, parents themselves saw that social media use was increasing in their community overall (such as among work colleagues), further propelling their comfort with their daughters' use and their own joining of social media.

With the popularity of social media, the nature of the restrictions participants faced evolved. Family members, relatives, and coworkers could now see participants' social media activity, noting when they saw "immodest" pictures or inappropriate comments from others on participants' content. We note here that women family members could be complicit in this monitoring. For example, intersections such as age may have affected how mothers see women's role in preserving their privacy and image and whether that is connected to the collective family. Participants described strategies that helped them avoid these invasions of privacy, in addition to the harassment from strangers that has been well-documented in prior work [99, 124]. Some participants pursued privacy literacy, learning from peers or through Google searches to restrict the visibility of their content from family, hide individual posts, filter messages from strangers, and block accounts. Notably, our two relatively older participants, both homemakers who were less tech-savvy but interested in using social media, did not necessarily care to learn about privacy settings. Instead they trusted their husbands to set them appropriately. Participants also chose to use different social media platforms entirely. One participant shared how she avoided family on Facebook: "*...to share and live a life I want, I have moved to Instagram where I have people who know me and understand my lifestyle.*" In other cases, participants pretended they were not on social media at all.

Our study points to the need to take a long and holistic view towards advocating for women's freedom to make choices regarding wellbeing. Changing collective attitudes and suspicions around social media only happened over time, based on participants' advocacy but also the slow process of older generations seeing change within one's community and feeling comfortable enough to align with it. Here, we can see how the central capability of senses, imagination, and thought is strongly linked to the capability of affiliation, or engaging in social interactions, and consequently, learning from them. As we have seen in the case of women's safety and social media use, there are multiple stakeholders who influence and even control women's decisions regarding mobility and technology use, and this extends to other domains like health, education, and finances. Accounting for these actors in the learning problem could mean thinking about how to create educational settings that bring together similar actors within a community, such as husbands, to allow for peer-learning about changing social norms.

We see that freedom of expression is tied to affiliation for women themselves, as well. One way is that learning might often happen in communities. For example, women learned about some privacy settings through friends, finding tools to handle shared struggles. Another way is that safe spaces of like-minded people can be helpful for freedom of expression, and learning how to create those spaces by navigating digital tools was extremely helpful for participants. In the absence of being able to reconcile individual and community values, creating online spaces and content restricted from family and other invasions of privacy allowed women to express themselves comfortably among like-minded peers. As Buskens has noted on designing for women's needs [18], it may be important to connect women within a community to each other, which could be crucial for articulating limits on their capabilities and finding the tools to address them.

Taking an intersectional view to this type of learning, we can see how not every tool or form of information is empowering depending on how women view their relationship to technology and digital literacy. For example, women who did not care to engage deeply with privacy settings and preferred to follow their husbands' suggestions, often homemakers among our participants, did not necessarily find privacy literacy essential to their social media use. This may have been because their values around social media use largely aligned with that of their husband, but it also indicates how whether information is empowering depends on women's priorities. In these cases, information dissemination may not matter as much as information discoverability, where information is easily available if women have a desire to engage with it. In the case of privacy settings, Sambasivan et al. have found that the introduction of new settings might not be obvious or privacy-related language could be culturally inappropriate or mismatched with many women's mental model of privacy [100].

Participants' increasing use of social media demonstrated how learning unfolds as related to change over time. Women themselves played a role in convincing those in their circle of influence about social media use, while affiliation was a conduit for parents accepting social media. At the same time, the notion of change and the learning required for it may differ based on intersections. Younger participants who held different values from their community learned about tools for maintaining privacy, while our older participants did not feel the need to do so, demonstrating how diverse identities shape motivations for learning as well.

4.3 Menstrual Health Education (Offline and Online)

Safety may be lacking not just in online and offline spaces, but also in health communication, particularly in the case of menstruation. This is a growing research area in HCI (e.g., [30, 34, 47]); prior work affirms the impact of cultural taboos in the context of menstruation, which prevents open discourse on a subject of crucial importance for *bodily health* as well as *bodily integrity* of women [84]. In India, menstruation has long been a stigmatized topic, though attitudes to menstruation are frequently intersectional, and there has been growing advocacy in support of de-stigmatizing the topic. This was amply evidenced by a recent political incident around women's lack of access to the Sabrimala temple in South India, where the temple authorities proclaimed that women would only be allowed in when a machine could scan them and declare them as "pure" or not menstruating [81, 116, 129][2]. The immense response to this decree in the form of long-lasting protests by women's advocacy groups highlights the polarization of society in this regard.

Towards developing an understanding of current approaches to MHE, we first conducted an in-depth contextual inquiry to understand how our participants (including doctors, teachers, health workers, young adults, and parents) sought, received, and disseminated MHE in both professional and everyday settings [119]. Our findings affirm that stigma prevents MHE dissemination in both school and family settings, leading to fragmented information-seeking behaviour of adolescents on the topic. Dominant education curricula introduce the topic at the age of 13 years, but explain the phenomenon of menarche to menopause in no more than 241 words. The subject is revisited in the tenth grade as a component of a chapter in Biology on Reproduction, but here the phenomenon is covered in only 97 words. Barring these texts, there are no formal avenues for adolescents to learn about menstruation, although schools tend to organize *ad hoc* workshops on the topic that are sometimes for girls only, and sometimes mixed gender, both causing their own sets of complications for the students.

Our findings clearly conveyed that there was immense need for improved information delivery on the topic of menstruation, though there was little agreement on where and by whom this

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[2]The general operating assumption was that all menstruators are women and vice versa.

information must be disseminated. Not only was it considered important to learn about what menstruation is, participants also complained that there was no common understanding on menstrual hygiene and management. Despite the many actors in this ecology, it was also clear that teachers preferred conducting girls-only sessions, and mothers were only concerned with sharing information with their daughters. Further, no stakeholders were willing to take the responsibility of educating adolescent boys on the topic; in some cases these participants had only learned of menstruation after they were married.

Our study of the Menstrupedia [74] platform was motivated by the desire to understand an approach to MHE that has received significant attention on account of its culturally responsive design. In studying various aspects of this platform, we found that there were more passive users (or lurkers) of the website than active users, and although Menstrupedia's focus was menstruation, topics of discussion ranged widely from sexual health to societal norms [118]. Additionally, we observed that the platform was seemingly being used by those who did not menstruate themselves, but had friends or family who did, and were seeking information for them. We found that although Menstrupedia was able to provide a space for satisfying curiosities on many stigmatized issues, it had also missed the opportunity to highlight to its readers that menstruation was not a topic meant only for women. Male members of the family could also be advocates and allies in the matter. Further, conversations around menstruation (in both studies) conveyed yet another intersectional complication by being limited to a binary understanding of gender: not all women menstruate, and not all those who menstruate identify as female.

Given how strong the attitudes around menstruation and, more broadly, sexual and reproductive health are, it becomes critical to take a long view to addressing them and their impact on women's health and wellbeing. Bodies also change over time and, with them, concerns around health. Here we must note that even if we are chiefly concerned with Nussbaum's central capabilities of *bodily health* and/or *bodily integrity*, it becomes important to consider how one might also exercise *control over one's environment* to be able to seek and engage with the health information one needs. This could perhaps be made less challenging if we were to work towards enrolling the support of the different ecological actors that we discussed above.

There are many learning problems here. Not only must adolescents be able to attain MHE, the stigma has a different impact on those who menstruate and those who do not, and these individuals might also need to learn how to respond to the others' particular perspectives. Further, adults (such as parents, doctors, and/or teachers) might need to also learn how to impart MHE, given the acute discomfort they experience in this regard. Finally, the fact that MHE does not pertain to a one-time occurrence but almost entire lifetimes means that approaches must be devised to facilitate learning across life stages.

4.4 Community-Led Video Education for Maternal Health

Women's health—maternal health in particular—has been a continued focus for ongoing work in global development, ever since this was the focus of the United Nation's Millennium Development Goals instituted in the year 2000 [128]; it is also included among the 2030 SDGs [80]. Nussbaum recognizes these health goals as featuring in the first and second central capabilities—life and bodily health, since they are heavily targeted towards curbing infant and maternal mortality rates [84]. However, an important finding in the case of PH [64]—a maternal health project that we designed and implemented in collaboration with community-based organizations in rural UP—was that several other central capabilities were hard to separate from the first two, as we discuss below.

In UP, maternal and infant mortality rates are among the highest in the country [125]. Against this backdrop, PH was aimed at disseminating information around topics relevant to maternal

and child health to new and expecting mothers. Short, high-quality films with involved storylines on topics around maternal and child health were created and screened by community-based organizations for members of local communities. PH's goal was to target behavior change at the household level, relying on the support of immediate and extended family members. Technologies used to achieve this implementation included low-cost camcorders, portable video projectors, and free video-editing software [64].

PH aimed to foster "participation" [17], stressing the importance for diverse stakeholders of rural Indian communities to work together. Health messages were crafted by respected members of the community, factoring in the advice of experts and other voices (such as those of ASHAs) from the community. The video production team then worked with the community to storyboard, film, and produce videos. The videos were then disseminated in monthly mothers' group meetings organized by ASHAs. Here, women got together in a public space such as the local school, and an ASHA would set up a projector, screen the video, and lead a discussion. These sessions were attended by new and expecting mothers, but also other women in their households [64]. In order to attend, these women also needed the permission of the male members in their households, who were duly kept informed about PH by the community-based organizations.

A key finding in the early days of PH (as also reported previously [60]) was that some ASHAs were proactively organizing unofficial video disseminations. On some occasions, it was because it was inappropriate for daughters-in-law from conservative households to leave the house. On others, it was because of disputes between other households in the neighborhood, which could prevent attendance of some mothers. Many disseminations would end up taking place without the knowledge of the community-based organizations who were broadly responsible for maintaining the projectors, creating the videos, and scheduling the dissemination sessions. However, the families whose homes had witnessed a dissemination turned out to be relatively more inclined to act on the lessons learned, because male *and* female family members had engaged adequately to learn the value of these videos. This was not possible in the case of women-only disseminations.

Through our PH engagement, we also uncovered that men in these communities frequently assumed that women would not know how to use multimedia features on their phones, although the women had a different story to tell [59]. Recognizing the realities of these women through an intersectional lens is helpful here, in order to acknowledge that some women were more digitally literate than others, also allowing for these literacies to transfer to other women over time. The ASHAs, who are typically better educated than other women in their communities, were savvy mobile users, and used multimedia mobile devices on a daily basis. Further, although the women in PH's targeted households did not have much free time, it was sufficient to find a window of time while cooking or resting to watch videos on their phones. This flexibility allowed them to engage with the videos repeatedly instead of once a month. This was an activity that came naturally because they were used to watching entertainment videos on their phones. We thus found that an affinity for play (a central capability in Nussbaum's list [84]) assisted in care-seeking.

Our findings regarding the ASHAs' proactive and unofficial disseminations, and the women's perspectives, helped iterate on the design of PH to also include dissemination of maternal health education through mobile media transfers. Here we saw affiliation (Nussbaum's seventh central capability [84]) play a role, evident in the social interactions that were configured to show concern and care for fellow human beings. Knowledge around mobile and media practices was key in reshaping PH as an intervention that aimed for the distribution of community health videos through mobile transfers, which took place due to different intermediaries. In follow-on research, we conducted a quantitative investigation of the distribution channels that could be leveraged to distribute mobile videos on offline information networks, and determined that ASHAs, mobile shop owners, and local community experts were consistent and reliable infomediaries [122].

The overall focus of PH was learning towards improved health outcomes through community-created videos. Even beyond these videos, however, we found that there were several opportunities for learning to take place—for other family members to learn how to assist and provide care in support, for male family/community members to learn the potential of these videos, for the ASHAs to be more effective in managing the dissemination, for the video production team to understand the ways in which information could be targeted to different audiences, and more. Each of these aspects presents challenges in and of itself, and needs careful attention to get the most out of PH.

4.5 Work Practices of Community Health Workers

In a project that deeply explored the work practices of community health workers or ASHAs in urban resource-constrained contexts, we conducted an ethnographic inquiry in and around health-care infrastructures targeting underserved populations in Delhi [44]. Global health work has recognized the role of ASHAs [52] as able and effective intermediaries facilitating access to health care among such communities. We corroborated these findings as we found the ASHAs to be in a unique position to surface patient perspectives and deliver knowledge to and from doctors [44, 45]. Although numerous global health interventions leverage the roles of these health workers using technology in various ways (e.g., [26, 64, 76, 91]), the potential for equipping them with technologies designed to improve their workflows remains underexplored. These kinds of explorations become even more essential in light of the workers' growing adoption of smartphones and data plans, currently the case in Delhi [46].

The ASHAs operate in various intersecting ecologies, as we found and documented [46]. They serve the health-care system as part of their work responsibilities, but they also interface with many community members, have their own social networks, support their households, and have begun to engage with the online world at large. In each ecology, there are "different kinds of difference" [130], relegating these workers to different sets of margins in each. Our research examined the participation of the ASHAs to understand how their evolving technological practices might be supported, leveraged, and extended. The lens of legitimate peripheral participation, proposed by Lave and Wenger in their work on situated learning, was instrumental in highlighting the learning challenges and opportunities faced by the workers in each of their intersecting ecologies [66].

An intersectional analysis demonstrated that our ASHA participants held a unique social position and greater visibility in their communities; this is atypical in resource-constrained and largely patriarchal contexts in India. Prior research conveys that marriage in deeply patriarchal societies can be accompanied by a sense of loss of identity for the woman [111]. We found this to also be true for our participants, although emergent social media activity appeared to be changing this. One of our participants observed, "*Everyone used to know me by my husband's name. But now [as an ASHA] they know my husband by my name.*" The desire to develop a stronger, louder voice was apparent in the ASHAs' online activities, as they used platforms such as Instagram and Facebook to express their likes, opinions, and affinities, using these media to express their individuality even beyond work purposes.

WhatsApp was widely used by the ASHAs for work as well—to interact with each other and better coordinate work in their particular areas. They frequently worked together to address any safety concerns that arose around traveling alone and to lend each other emotional support when needed [25, 45]. More complex scheduling was also now possible as multiple ASHAs could discuss meeting times with greater ease. ASHAs shared additional work-related information regarding training sessions, salary deposits, and immunization dates. Through WhatsApp, our participants were able to widen their circle of ASHAs and include those from other areas, identify and communicate shared struggles, and support each other's online and offline activities. These activities played a large role in promoting activist behavior and led to a movement for a salary hike and other

benefits [45]. We also found that WhatsApp was used to circulate information such as the list of demands from the government, headway made with the government, organized strikes and meetings, news articles, and other updates. The medium not only allowed proactive ASHAs to participate actively regardless of where they were located, but also allowed other ASHAs to stay informed. We found that ASHAs also interfaced with their supervisors, staff, and doctors at the primary health center (PHC) level, though higher authorities were not connected to ASHAs via similar channels.

On the one hand, we find that the ASHAs are directly addressing the first two on Nussbaum's list of greater capabilities [84]—life and bodily health—for the women in their communities that they regularly engage with. Viewed from the perspectives of the ASHAs themselves, several others are also relevant, such as affiliation, play, as well as control over one's environment. These capabilities become critical because they enable the ASHAs to be more effective on a day-to-day basis as they perform their duties around caregiving and data collection. Our analysis also highlights that the ASHAs' realities viewed through an intersectional lens are directly tied to the roles they play, and potential impact they can have, in different ecologies. Being relatively more empowered than many of the women they have interactions with, these ASHAs are able to positively impact care. On the other hand, their weak ties with the doctors and other government actors prevent effective knowledge-sharing and leave the doctors less informed about ground realities, as we have previously documented [45].

The focus of our earlier analysis was on the ASHAs, and how they gradually become more active members in their different worlds [46]. They gain digital literacies, they become more adept at communicating via (public and private) social media, they learn to balance their work responsibilities better, and more. These are all learning challenges to be overcome. However, in the complex ecologies where they function, there are also other forms of learning that may be essential. For example, for the doctors and healthcare infrastructures overall to be more effective, they must also shift their attention to existing ground realities and offering patient-centered care, as previously highlighted [44]. This would require them to understand diverse cultural practices, and existing care-seeking behaviors, among other things.

4.6 Aspirations of Financial Independence

In the case that follows, we retreat from a health-care context to a learning environment, to present findings from fieldwork conducted at an after-school center for girls in Baruipur, West Bengal. This region is notorious for its problems of trafficking and child marriage [101], and the primary mission of the center we studied—as conveyed to us—was to ensure that the girls stayed in school so that they would not be trafficked and/or married early; formal learning goals came second. The staff at the center were thus primarily concerned with providing protection from the world outside, so they could reassure the parents that their daughters would be in a position to continue to study in college and/or secure jobs, gain financial independence, and take care of their parents in old age. Here we note a strong focus on the central capabilities of *life*, *bodily health*, and *bodily integrity*, as well as a strong leaning towards (re-)gaining *control of one's environment* [84].

There was also a deep commitment to ensuring the dignity, self-respect, and non-humiliation (*affiliation*) of these girls, and their ability to imagine, think, and reason as they cultivated their aspirations for the future (*senses, imagination, and thought*) [84]. In affirming their keenness to avoid early marriage, more senior (girl) students also laid out their aspirations, where they asserted their desire to receive the requisite training for securing "respectable" jobs. They mentioned that, in the ideal scenario, they imagined themselves working day jobs and financially supporting their families. They also expressed the desire to study further and attain a college education, bearing the cost of this education themselves. This was partly due to their reluctance to ask their parents to bear the burden of their expenses, but also because they wished to be financially independent.

The repeat emphasis on financial independence, as we understood, stemmed from the fear that being financially dependent would cause the parents to perceive their daughters as a burden and arouse inclinations to marry them off. Studying well was also viewed as a necessary step towards those aspirations, as one of the students noted, "*If we don't work and don't earn money, they (our parents) will get us married, as we cannot contribute to the household income. Also, if we do not study, our parents will think we cannot have a future of financial independence, they will marry us off. We will do both.*"

We studied deeply the role of different actors in this ecology—the girls, the parents, and the staff in particular—and tried to understand how their goals aligned to generate avenues for the aspiration of financial independence to be achieved. Not only were there intrinsic and extrinsic motivations that drove the girls to set financial independence as an aspiration, the fulfillment of this aspiration also depended on the support they could secure from their surroundings (or not). We learned from the after-school coordinator that these girls had the option of pursuing several different forms of vocational training (such as creating handicrafts), but the girls "*desired computer training only.*" This was a desire that the center was able to entertain, and it did introduce computer training courses for 40 girls who were close to graduation. However, the girls were also inclined to use mobile phones, which the center was unwilling to provide out of concern that the technology could be used for "*good and bad*" purposes. For example, it was possible that the girls would receive calls from strangers (mostly young men) and start a relationship, which could lead to undesirable outcomes for the girls.

Having made four visits distributed across 1.5 years, we were able to assess how the aspirations for computer (and English) training took shape over time. Some girls who had received this training did succeed in securing jobs, while others shared the challenges they faced in interviews, often on account of intersectional factors. For example, the girls were concerned that their prospective employers preferred fairer skin, a common tendency among orthodox Indians [49], or if they would end up finding themselves in the same world (with the same values) that they were trying so hard to escape from to begin with. They were pulled into a process of recalibrating the aspirations they had earlier held, sharing their newly formed understanding that the jobs they had hoped to get were not quite the ones they were going to end up with. Even those who were employed struggled to pursue higher studies, since most of their time and energy were consumed by their jobs. Also, certain desirable job openings were only available to college graduates (such as nursing); this knowledge was not available to the girls early enough. Upon culmination of our study we found that the girls still firmly believed that computer training held the answers, but also that *more* training was required so that they could aspire for jobs that were more stable and better paying.

Learning English and "*learning computers*" were both viewed as valuable by most of our research participants, in addition to completing their schooling in general. There are other forms of learning that also emerged as critical for the long-term goal of achieving financial independence, such as developing an understanding of short-term career decisions that might lead there. The center made great efforts to get the parents on board, but the mothers reported that convincing the "*males in the family*" remained a challenge. Parents—mothers and fathers—need also to be encouraged to learn the importance of educating girls, in support of several of Nussbaum's central capabilities [84]. Further, learning opportunities are best targeted at different points of intervention, and at different points of time. As we saw in this study, each time aspirations needed calibration, new learning goals were conceived and defined, and/or old ones were revised.

5 A LONG, INTERSECTIONAL, HOLISTIC VIEW TO WOMEN'S WELLBEING

Taken together, these cases above highlight that "women's health" is not merely a challenge of bringing health care, or bringing information about health care, to women. Designing for women's

health requires us to think beyond physiological conditions alone, to consider how to support the interrelated freedoms, or Nussbaum's central capabilities, that contribute to women's overall wellbeing [84]. Such a shift also entails a long, intersectional, holistic view to women's wellbeing, our cases illustrate. Given the importance of engaging multiple stakeholders and considering the affective aspects of health, we might benefit from greater intersectional awareness—both in understanding target users and designing for them. Additionally, desired health outcomes do not have a limited time span. Not only are many health problems long-lasting, the precise nature of the problem might also change with time. We elaborate on these lessons learned below, relating them to our cases, before suggesting how research, design, and practice in the domain of women's health and HCI might advance. In particular, we discuss how, in each of the cases presented, the design challenge may be cast as a learning problem. We then make the case for approaching these diverse learning problems using DBIR [33]. We also argue that this is a fitting lens for such design challenges because of its fundamental focus on sustainable, ecologically appropriate, and iterative design-based research.

5.1 From Health to Wellbeing

Our cases illustrate how women's health is affected by not just physiological conditions and access to health care, but also systemic factors that limit the central capability of bodily health and integrity. These factors include the constant threat of physical harm and invasions of privacy, which women may be perfectly knowledgeable about and yet do not receive proper support in addressing. Then there are aspects of health that girls and women may benefit from learning about in a more purposeful way, which could support their capability of thinking through personal decisions around health. However, a focus on information dissemination targeting women misses many crucial factors, such as involving multiple critical actors in women's lives, understanding how and where learning opportunities arise for girls and women, and increasing the effectiveness of infomediaries like ASHAs. Finally, there were girls and women among whom capabilities of bodily health and integrity were purposefully met, but this did not mean that wellbeing was always assured. ASHAs required affiliation not just among themselves or women in their community, but also doctors or government actors. Meanwhile, students at the after-school center in Baruipur still needed greater guidance on how to achieve goals that would offer some respite within the patriarchal context they were embedded in.

A focus on capabilities can support this shift from health to wellbeing. This entails working towards the rights and freedoms of women regarding wellbeing, as opposed to using information to have women narrowly align with what Sen and Nussbaum call *functionings*, or certain ways of *doing* and *being* [84, 105]. A capability approach here is then less about encouraging certain actions and more about checking that there are no limitations on actions, prompting us to question what processes limit women's capabilities. There may also be linkages as well as tensions across capabilities. From our cases, we also see that the central capability of bodily health is tied to many others, including bodily integrity, affiliation, senses, imagination, and thought, and control over one's environment, so restrictions on one capability might be affecting others. We see that it is not just women's capabilities that matter for their wellbeing, but also other stakeholders, such as the affiliation and educational opportunities for men, parents, and in-laws. These nuances of wellbeing inform the considerations for HCI research, design, and practice below. Here, we caution that the central capabilities should not be seen as an exhaustive list applicable everywhere. Determining which of the capabilities are applicable and how, and the relationships across capabilities must remain a contextual and negotiated practice.

5.2 A Holistic View

Each of our cases highlights the importance of taking an ecological perspective, drawing attention to the multiple stakeholders involved in securing women's health. We highlighted how women cannot easily avail health care unless their family members are willing. We saw that their experiences of participating on social media are impacted by the presence of ill-intending actors online. Their physical safety also depends on external infrastructures in large part, among other factors. Addressing women's wellbeing is not possible without directing attention to these multiple stakeholders as well. Positive outcomes to wellbeing require that others' behaviors also support these outcomes. This is also highlighted in Bardzell's framework for feminist HCI, which asks that technology design factor in the context, not merely the user, and proposes *ecology* as a key principle of the framework [12].

The challenge is that in most of our cases, the ecological perspective uncovers conflicting goals. The conflict may be between the researcher/designer and a particular stakeholder, or across stakeholders, or both. Sultana et al. and Buskens, among others, have drawn attention to the challenges that researchers and designers must contend with if they are to work with participants and contexts where values might be differently placed [18, 111]. With the principle of *advocacy*, Bardzell suggests that we question our own positions (as researchers or designers) to "*assert what an 'improved society' is and how to achieve it.*" Such reflexivity is critical and typically desirable, but may not always be sufficient. Where women's wellbeing and related capabilities are concerned, there may be no way to move forward, in many cases, without also sidelining the freedoms of men and unavoidably raising thorny struggles around power. While this may seem like a wicked problem with no clear solutions [97], given conflicting goals among stakeholders, Nussbaum explains why this is not so. She explicitly raises these challenges in the context of gender justice, explaining how under patriarchy, limiting men's freedom (such as criminalizing marital rape) is a prerequisite to women's freedom [84]. She argues that we must make decisions around which freedoms are harmful, and in such scenarios it is acceptable, even essential, to sacrifice the freedoms of men. This may be practically untenable, however, and may require a careful understanding of the freedoms at play and under attack. This draws our attention to the multiple, intersecting axes of differentiation that shape the privileges individuals have, which we discuss next.

5.3 An Intersectional View

Taking an ecological perspective can afford a wider and more holistic view of the challenge of targeting women's health. However, we also need lenses that will allow us to understand with more nuance the lived realities of these women, the freedoms they have or do not have access to. In each of our cases, we uncover the presence of multiple forms of marginalization. It is not simply that our participants are women or that they are Indian. We are able to better understand their struggles by attending to their specific positions as women in particular Indian contexts. We also see that intersections such as class (which can also be closely tied to caste) and literacy levels are relevant to their experiences. The additional stigma around menstrual health could add yet another level of complexity. For example, transgender individuals' challenges with menstrual health and other bodily processes may manifest very differently.

There is a rich history of intersectional work within and outside computing by women scholars of color, particularly black women [24, 115]. Intersectionality emerged as a theoretical framework in the context of the experiences of black women in the United States, who grapple with both racism and sexism simultaneously [24, 96]. Outside the United States, women from marginalized groups may face struggles that similarly emerge as a result of gender intersecting with other axes of marginalization, though the struggles and intersecting identities may be different. Several scholars

have called for a focus on intersectionality in HCI and computing. Schlesinger et al. have underscored the importance of paying attention to diverse and intersecting identities [104]. Developing this further, Wong-Villacres et al. have recommended ways in which intersectional analysis can help uncover pathways for design [130]. An intersectional lens is not optional; it must undergird any methodology that we use.

Thomas et al. and Kumar and Karusala have emphasized, in their respective calls for *intersectional computing*, the need for greater awareness of intersectionality across domains of computing, and careful examination of how emerging computing technologies may be configured to impact the lives of variously vulnerable populations [62, 115]. Kumar and Karusala further point out that the unfolding discourse around intersectionality within HCI has largely been focused on particular axes of differentiation, such as race or gender, but "*there are also less explicit marginalized aspects of identity that a deeper engagement with the lens of intersectionality might surface, such as nationality, domain of work, and linguistic ability, among others*" [62]. Taking the example of Menstrupedia, we saw that while the comics focused on the struggle of communicating about a taboo topic, the lack of attention to involving male family members and the use of binary genders were additional intersectional issues that may need to be addressed in design.

5.4 A Long View

In much of the related work that we cite, design-based research and interventions do not typically take time spans into account [32], but in considerations of health and wellbeing as we found, considering the role and relevance of time is critical. This may be for many reasons. For example, needs could be long-lasting, such as the need for physical safety. It is not enough for safety to be guaranteed in one context or on one day, it must be guaranteed at all times, and on a consistent basis, our participants affirmed. The life stages one is designing for are also important. For example, the need for considering menstrual hygiene needs in design may only be relevant during the time that one is menstruating, which is typically for a few days a month and not at every age. Design for delivery of care may also need to evolve with time; a pregnant woman's health-care needs change drastically after giving birth and the ASHAs were required to respond to these needs without adequate training. Design may require scaffolding, such as in the case of women who were going online and gradually learning to participate more actively on social media. Finally, design may need to be adaptive and allow for recalibration, such as in the case of the girls in Baruipur, where their aspirations around technological engagement changed with time.

Any commitment to design then, especially in the context of designing for women's wellbeing, must also take time into account, our research shows. Innovating around mechanisms of design engagement that can be sustained through time could uncover new potential for design to have impact. Identifying the scope within which a design might adapt could also be potentially useful. This requires as much a sensitivity to changing life conditions, such as menarche and menopause, as it does to the gradual development of human capabilities over years.

6 TAKING A LEARNING-BASED APPROACH

Thus far, we have drawn on our cases to emphasize that we must reorient our perspectives around the problem of "women's health" to focus instead on women's wellbeing, as defined by Nussbaum's exposition of the Capabilities Approach [84]. We have also highlighted the importance of taking a long, holistic, and intersectional view of women's wellbeing. With this as our empirically supported foundation, we suggest that HCI research, designers, and practitioners address women's wellbeing by taking a learning-based approach. We also propose DBIR as a fitting approach that aligns with and unifies each of the above constructs in the context of learning ecologies.

6.1 Why Learning?

Education research is increasingly recognizing that learning does not take place within the confines of the classroom alone, but is "life-long, life-wide, and life-deep" [10]; it takes place across multiple and informal settings. As we turn to these diverse settings, we must consider learners' histories of engagement with particular content areas, how they come to engage with that content (or not) in other life settings, and how their access to engaging with such content is organized. Our cases illustrate that a significant set of challenges around women's wellbeing may be cast as learning problems, on account of inhibited learning for reasons that might be cultural, ecological, disability-related, among other things. In addition, a lens of learning both reveals and requires an understanding of time, ecologies, and intersectional variations so as to address women's wellbeing in actionable ways. Though we have alluded to the need for learning in our case descriptions, we go into more depth below.

To secure a sense of safety in public and online spaces, women must and do learn ways of managing their clothing, surroundings, technological safeguards, among other things. These lessons are cultivated over time, through family and friends concerned for their (and each other's) wellbeing. However, being vulnerable to harassment online or offline must not be women's problem alone, as Nussbaum contends [83, 84], and a learning lens highlighted how ensuring women's freedoms could require other stakeholders' participation as well. Framing this as a learning problem means that design might focus on learning among diverse stakeholders (such as law enforcement officials or family members), particularly around women's experiences as well as how one can be in solidarity with them. As described in our cases, however, receptivity may be a serious challenge and factors like affect, such as parents' worry, and culture, such as workplace norms within law enforcement, need to be given consideration. For this reason, it is important to also recognize that women might already be educators (though informally and perhaps out of necessity) advocating for change in their community. The research and design process might learn from women's efforts to gain a better understanding of the points of change as well as the resistance to it that they encounter.

In the case of maternal and MHE, the focus was already on learning, but delving into these learning problems in this article highlighted complexities due to stigma. For example, even when the central goal is for those who menstruate to learn about recommended health practices, learning among other stakeholders such as family will likely need to be tailored to how they have been socialized to think about women's wellbeing. They may not need to learn how to manage menstrual needs that they do not have, but it is still critical for them to appreciate the challenges that those who menstruate experience, and to support them as best possible. Here, stigma makes it necessary to innovate around mechanisms and sites of delivery, as Menstrupedia sought to do [74, 119]. Also, PH saw the women engaging with community-generated videos, but the focus of the intervention was not so much on their receptivity to this information as on facilitating access to it in the first place. Considerations for the learning of male family and community members were made on an *ad hoc* basis, as we found, and the use of mobile devices as well as "clandestine" disseminations were appreciated precisely so that husbands and/or fathers-in-law could also learn alongside their wives and/or daughters-in-law. Targeting their involvement and perspectives as learners could have made the PH intervention more impactful earlier on.

Our final two cases investigate work practices and financial independence. Through a learning lens, we were able to hone in on the actual processes through which women and girls tried to enact change in their own lives. We found that learning had to happen in many different areas of life, and learning goals also needed to shift in order to more realistically reach aspirations. In conducting community health work on a daily basis, health workers are beginning to use mobile devices to coordinate work schedules and report to their supervisors. However, the larger ecology reveals a disconnect between the challenges that these workers face, for example, in their data collection

practices, and the understanding that the doctors have of these work environments, hindering workers' efforts to be more involved in and lead community health. Additionally, there is little appreciation among the workers around what the data they collect will be useful for. Bridging disconnected knowledges through learning interventions can be instrumental towards the success of health-care interventions as well as women health workers' agency. In the case of the girls in Baruipur, we saw that learning technology skills was not the problem, but learning to aspire was. This might directly translate to examining the learning that teachers at the after-school center may need to undergo to identify appropriate interventions. Even the parents of the girls might need to undertake dedicated learning activities to recognize the possibilities for their daughters.

By shifting focus to learning, we propose that issues around women's wellbeing be framed as learning problems that consider the factors highlighted in our cases—by identifying the different actors in the ecology, and their intersectionally diverse (possibly conflicting) stakes, over varying periods of time. Viewing these ecologies as complex and multi-dimensional learning environments, we might view diverse stakeholders as having different challenges in learning, whether this learning is around mastering information on health-care needs, or around the difficulties women face in understanding reasons for unfolding bodily changes, or something else. As a general approach to identifying and addressing these challenges, we recommend engagement with the DBIR framework.

6.2 Engaging DBIR for Systemic Change

DBIR is a framework that was proposed within the field of education, as explained on a website that provides guidance on its methodologies[3].

> "*Design-Based Implementation Research (DBIR) is an approach to organizing research and development intended to promote effective, equitable, and sustainable improvements in education. It is an emerging method of relating research and practice that is collaborative, iterative, and grounded in systematic inquiry. DBIR builds the capacity of systems and partnerships to engage in evidence-based, continuous improvement as they work toward the transformation of teaching and learning.*"

DBIR was developed to address the challenges of sustaining and scaling up research-based innovations in learning contexts, and emphasizes design and research with a special focus on the issues of broader implementation [32]. Kumar and Dell's inquiry of how HCI4D researchers and practitioners could be more productively aligned as they work towards systemic change highlights the potential of DBIR in connecting research and practice [61]. We extend their research as we elaborate on the role that learning plays in the context of women's wellbeing in marginalized communities. We demonstrate that DBIR is fundamentally aligned with our proposed orientation towards women's wellbeing. Our intent is for this framework to inform future design and interventions targeting women's wellbeing that are sustainable and in alignment with multiple stakeholders. We first lay out the following four principles of DBIR in order to understand their relevance for our cases and others like them [32]:

(1) a focus on persistent problems of practice from multiple stakeholders' perspectives;
(2) a commitment to iterative, collaborative design;
(3) a concern with developing theory and knowledge related to learning and implementation through systematic inquiry; and
(4) a concern with developing capacity for sustaining change in systems.

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[3]http://learndbir.org.

How would these principles actually work in the context of women's wellbeing and systemic change? Taking the example of women's safety, collaboration might take place in a task force containing government leadership, law enforcement, media, systems developers, and citizens. Learning questions might be around how law enforcement (both existing and new) can be sensitized to women's safety issues, or how the government might disseminate narratives around sexual harassment and women's safety interventions. Because of DBIR's focus on multiple stakeholders' perspectives and barriers in practice, any project would need to consider how to create the will for forming and sustaining such collaborative platforms. This may be difficult in the context of women's wellbeing, particularly when stakeholders are resistant to change or even to putting more than minimal resources into women's wellbeing, let alone over the long term. Reiterating the point that ecologies of stakeholders can often surface wicked problems due to unaligned interests, we recommend that Nussbaum's Capabilities Approach might aid in recognizing when certain freedoms must be prioritized (see 5.2) [84, 97]. We also view research and design as ways of evidencing the feasibility and effectiveness of interventions for women's wellbeing, which could bolster the push for political and social support for women's empowerment.

We also discussed above the importance of iterative, collaborative design in our cases. Fishman et al. suggest that this practice allows for different stakeholders to take turns participating while giving importance to learning [32]. We additionally argue that iteration is essential for taking a long view to women's wellbeing. That is, we might iterate not just to polish specific ideas but also to follow different life stages and changing lifestyles. An example where this is relevant might be a collaboration among researchers, practitioners such as the creators of Menstrupedia, teachers, parents, and children to co-design an educational platform for menstrual health that could be engaged with in both the school and home. We could see how close and sustained collaboration among stakeholders would be important for bridging different learning environments and actors of all ages who influence MHE as children grow up. However, as has been a long-standing theme in activist efforts around women's empowerment, collaboration may also present complexities, such as co-opting of projects to serve the interests of those with more powerful voices. Taking the case of community health, for example, there might be an opportunity for collaboration among technologists, government actors, ASHAs, and community members to design a platform for visualizing and learning from data on community health. However, even if stakeholders might agree on this overall goal, government actors, who often provide resources in this context, may have different uses for data than ASHAs or community members. An important factor to consider in DBIR in this context might be moderation—if certain freedoms must be prioritized, what decision-making and communication practices must be in place to consistently amplify women's voices when making design choices or deciding what needs iteration over the timeline of an intervention?

Given that "women's health" is still a developing area within HCI, there is great potential for developing knowledge and theory in this domain. DBIR's commitment is to develop knowledge that could be useful across a range of settings—not just for researchers in academia but also designers, learners, and others. Applied across our cases, this would include academic research on understudied topics that are relevant to women's wellbeing, but also a production of knowledge and/or technological artifacts that might be useful to practitioners with very different orientations, such as non-governmental organizations, teachers, or ASHAs. In fact, this could be a form of advocacy that presents systematic understandings of women's diverse and intersectional experiences to multiple stakeholders. In the long term, the prioritization of using these understandings to develop theory on women's wellbeing would also contribute to the diversification of theory in general. This is an important political project in academia more broadly that aims to center diverse experiences in understandings of human behavior.

What novelty might DBIR bring then, if it is already fundamentally aligned with our cases, and others like them? As Fishman et al. express, what is new about DBIR (and useful for our goals of designing for women's wellbeing) lies not in any single principle among these four, but in their integration into a unified design approach for learning ecologies [32]. Together, these principles offer a way to operationalize a lens of learning such that it aligns with our view of wellbeing as holistic, intersectional, and longitudinal. As we draw upon DBIR as one potential approach for targeting systemic change through learning, we can also contribute to developing this framework in support of future aligned interventions.

7   CONCLUSION

In this article, we consolidated our findings from 13 research studies and 6 cases conducted in the last 5 years across Indian settings and demographics, all with a focus on women's interests. We argued for expanding the scope of "women's health" to "women's wellbeing," drawing on these cases and Martha Nussbaum's exposition of the Capabilities Approach [84]. We then highlighted the importance of taking a long, holistic, and intersectional view to women's wellbeing. Although the focus of our research and analysis is the Indian context with its cultural particularities, we believe that this analysis also extends to other cultures and geographies around the world. Though verification of this would require further directed investigation, recent research by Caroline Criado Perez [90] highlights many barriers to wellbeing that are shared by women across the world. Likewise, factors such as length of time and changing health needs, intersectional diversity, and complex ecologies are also complicit in other contexts. Thus we encourage researchers, designers, and practitioners working in related areas to consider the approach we suggest, of casting design challenges in this realm as learning problems and exploring the value that DBIR might lend. Making this shift as a community also aligns with a view of gender justice that goes beyond the basic ability to survive to the more generative ability to thrive. We leave readers with "Bread and Roses," a poem rooted in struggles for recognition of women's labor, that calls for the necessities, bread, but also nourishment, roses:

> *As we come marching, marching, in the beauty of the day,*
> *A million darkened kitchens, a thousand mill-lofts gray*
> *Are touched with all the radiance that a sudden sun discloses,*
> *For the people hear us singing, "Bread and Roses, Bread and Roses."*
>
> *As we come marching, marching, we battle, too, for men—*
> *For they are women's children and we mother them again.*
> *Our days shall not be sweated from birth until life closes—*
> *Hearts starve as well as bodies: Give us Bread, but give us Roses.*
>
> *As we come marching, marching, unnumbered women dead*
> *Go crying through our singing their ancient song of Bread;*
> *Small art and love and beauty their trudging spirits knew—*
> *Yes, it is Bread we fight for–but we fight for Roses, too.*
>
> *As we come marching, marching, we bring the Greater Days—*
> *The rising of the women means the rising of the race.*
> *No more the drudge and idler—ten that toil where one reposes—*
> *But a sharing of life's glories: Bread and Roses, Bread and Roses.*
>
> —James Oppenheim, 1911

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