Mental Wellbeing at Work: Perspectives of Software Engineers

Novia Wong
noviaw@uci.edu
University of California, Irvine
Irvine, CA, USA

Victoria Jackson
vfjackso@uci.edu
University of California, Irvine
Irvine, CA, USA

André van der Hoek
andre@ics.uci.edu
University of California, Irvine
Irvine, CA, USA

Iftekhar Ahmed
iftekha@uci.edu
University of California, Irvine
Irvine, CA, USA

Stephen M. Schueller
s.schueller@uci.edu
University of California, Irvine
Irvine, CA, USA

Madhu Reddy
mcreddy@uci.edu
University of California, Irvine
Irvine, CA, USA

ABSTRACT

Software engineers exhibit higher burnout and suicide rates compared to many other information workers. Consequently, mental wellbeing is a growing concern to technology organizations. To better understand the challenges of supporting mental wellbeing in the context of the work of software engineering, we conducted 14 interviews with software engineers. We examine the different aspects of their lived experiences with mental wellbeing at work, their strategies for managing mental wellbeing, the challenges they face in using these strategies, and recommendations they have for mental wellbeing technologies. We contribute to the HCI literature by discussing how mental wellbeing should be considered within the context of work across individual, team, and organization levels, and highlight the need for integrating mental wellbeing into the technologies employees use at work.

CCS CONCEPTS

• **Social and professional topics** → **Socio-technical systems**; • **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Health-wellbeing, Workplaces, Empirical study that tells us about people, Interview

ACM Reference Format:
Novia Wong, Victoria Jackson, André van der Hoek, Iftekhar Ahmed, Stephen M. Schueller, and Madhu Reddy. 2023. Mental Wellbeing at Work: Perspectives of Software Engineers. In *CHI'23, April, 2023, Hamburg, Germany*. ACM, New York, NY, USA, 15 pages. https://doi.org/10.1145/3544548.3581528

1 INTRODUCTION

Mental wellbeing exists on a continuum with "flourishing" on one end and "in crisis" on the other [25, 51]. The mere presence of positive emotions or the absence of negative emotions does not guarantee that an individual's mental wellbeing is flourishing. Furthermore, mental wellbeing is multi-faceted and includes not only an individual's emotional wellbeing, but also their social and cognitive wellbeing [38, 65, 114]. Consequently, an individual's wellbeing is dynamic, changing over time due to a variety of internal and external factors. When employees' mental wellbeing is not well-managed, they can suffer physical health problems and organizations can face problems with employee productivity and retention [43, 76, 117].

Within HCI, mental wellbeing has been studied in different contexts and with different populations [99, 100]. Specifically, within work settings, HCI studies have largely focused on the incorporation and evaluation of digital evidence-based solutions that utilize techniques such as cognitive-behavioral therapy (CBT) and mindfulness exercises to improve mental wellbeing [28, 53]. Recently, there has also been a growing interest in studying mental wellbeing at work through measuring biometrics [2] and delivering stress-reduction activities at the "right" times through stress-sensing and just-in-time interventions [4, 28, 53]. Outside of HCI, researchers have primarily focused on understanding and creating solutions for specific aspects of mental wellbeing at work, including diagnosed mental illnesses [123], employee happiness, overall job satisfaction, stress management [120], and productivity [43]. A popular model that has been used to understand contributing factors to mental wellbeing is the Job Demand Control Support (JDCS) model. It states that an employee's mental wellbeing is influenced by the amount of demands, control, and social support at work, with high strain jobs those that exhibit high demands, low control, and low social support [60]. While not specific to the JDCS model, other studies have found similar contributing factors such as work-life imbalance [6], interpersonal conflicts and lack of social support [48, 73], lack of autonomy at work [48], constant interruptions [74], and other societal factors such as gender identity [73].

Despite an increased focus on mental wellbeing in organizations and their policies, employees continue to experience poor mental wellbeing at work at an alarming rate [88]. In this study, we focus on particular group of employees whose work seemingly fits the high strain JDCS profile – software engineers. They have been identified as having one of the most stressful and intensive jobs, with one of the highest employee suicide rates [18]. Their work demands them to engage in deadline-driven work [41], regularly requiring them to work overtime. Especially today, they often work in a remote environment, which may lead to feeling of isolation and loneliness [103]. Software engineers also work with technology for a long periods of time for both individual work and collaborative activities. Studying this population from a HCI perspective

CHI 2023, April 2023, Hamburg, Germany

ACM ISBN 978-1-4503-9421-5/23/04.
https://doi.org/10.1145/3544548.3581528

is therefore important because it allows us to understand how to introduce new mental wellbeing management technologies to a technology-reliant, high-strain work population.

Our first step in developing technologies to address mental wellbeing challenges faced by software engineers in their daily work is to understand their lived experience. We conducted an interview-based study with 14 software engineers from a variety of work settings (e.g., large companies, start-ups) in the United States of America (U.S.A), who held a variety of job titles, including associate software engineer, backend software engineer, and principal software engineer. Through this study, we examine how poor mental wellbeing manifests in the work of software engineers. We also examine participants' strategies to manage their mental wellbeing, the challenges they faced in using those strategies, and the recommendations they have regarding mental wellbeing technologies. Influenced by similar studies in HCI and social sciences that explore general mental wellbeing through the lens of social ecological models [31, 82, 110], we found that mental wellbeing at work is a multi-level challenge that spans the individual, team, and organization. We also articulate a better understanding of contributing factors to software engineers' mental wellbeing such as time wasted on job tasks and self-doubts over job performance. Our study contributes to the HCI literature in three ways by:

(1) Providing an understanding of broader mental wellbeing at work as a multi-level challenge, in which different aspects of mental wellbeing (e.g., contributing factors and strategies used) operate at and across three main levels: individuals, teams, and organizations;
(2) Identifying challenges faced by software engineers in utilizing current strategies and technologies to manage their mental wellbeing; and
(3) Discussing approaches using work technologies to address mental wellbeing, especially from the perspective of new directions that may overcome some of the existing challenges.

Our first two contributions allow us to begin considering the design requirements needed for integrating mental wellbeing into work technologies. Our third contribution then begins the conversation of possible technological designs for such integration.

2 BACKGROUND AND RELATED WORKS

2.1 Mental Wellbeing

Mental wellbeing has various definitions and is a concept that has been studied in multiple fields, including psychology [94], philosophy [116], and HCI [112]. Although there is no single canonical conceptualization of mental wellbeing, one characteristic that spans multiple conceptualizations is that mental wellbeing is not binary but a continuum. Specifically how this continuum is labeled varies; some have used "flourishing" to "languishing" [64], and others have used "excelling" to "in crisis" [25].

Mental wellbeing is multi-faceted and consists of different factors. For example, in the hedonic (i.e., pleasure) and eudaimonic (i.e., purposes) conceptualizations [24], affective, cognitive, and behavioral factors all contribute to one's mental wellbeing. Other conceptualizations similarly included a diverse sets of factors, particularly social factors [38, 65, 114]. Because these different factors can change over time, mental wellbeing [34] therefore is not static but dynamic.

Within HCI, studies have explored mental wellbeing in different contexts and with different populations, including healthcare [113], social media [95, 96], and teens and college students [10, 81]. A sizeable amount of HCI research on mental wellbeing on sensing, tracking, and delivering interventions via gamification and mobile technologies [55, 63, 99, 100, 114]. Studying mental wellbeing in the context of work has been an especially important and ongoing conversation within HCI [19]. Our study takes the opportunity to further explore the lived experiences of individuals' mental wellbeing from an integrated perspective that acknowledges the complexity of mental wellbeing.

2.2 Mental Wellbeing in the Work Context

Workers have experienced declining mental wellbeing in recent years [88, 124] that has led to costly consequences for both the employer and employees. 52 percent of surveyed workers in the U.S.A indicated they experienced more burnouts in 2021, with 67 percent across all age groups believing that they experienced worsening burnout since 2020 [115]. Similarly, a comparison of survey data from 2019 and 2021 shows an increase from 59 percent to 76 percent of U.S.A workers who have experienced signs of poor mental wellbeing [88]. For the employer, some of the impacts are reduced employee productivity, lower job performance [43, 72, 108, 123], and difficulties in workforce retention [45, 106, 109]; for the employee, poor mental wellbeing has led to worsened physical health [117] and spillover effect into personal life [8, 47].

One framework useful for looking at mental wellbeing in the workplace is the Job Demand Control Support (JDCS) model. The JDCS model states that wellbeing at work is influenced by job demands, job control, and social support [60]. Job demands include any tasks that require physical or cognitive effort; job control includes employee autonomy at work and skill contribution; and social support refers to the relationships between employees and their colleagues and supervisors [32, 60]. Based on a low-to-high spectrum for all three components of the model, different job profiles have been created, such as low strain, active, passive, and high strain [60]. Past studies in HCI have used this model to develop contextual personas [126] to better understand employee needs. Other studies that have identified specific contributing factors to poor mental wellbeing at work, such as a lack of social support [6] and a lack of autonomy over work responsibilities [48, 51], also align with the JDCS model. Other common factors include failure to integrate work and personal life [6], poor company culture around work and mental health [45, 51], and interpersonal conflicts with coworkers [48, 51, 73]. Individual differences such as personality traits[75, 87], emotional control and self-motivation [20], and social structures [73] also influence the extent to which an individual experiences the impact of these work factors on their mental wellbeing. Within software engineering, additional factors include interruptions [57, 68, 125], interpersonal conflicts during engineering tasks (e.g., paired code review) [40], unmet job needs [68], and working overtime [85]. Socio-cultural factors such as gender and race are also contributing factors. For example, female software engineers

are more likely to experience micromanagement and imposter syndrome, leading to poor mental wellbeing at work [118]. The JDCS model is therefore useful to help us understand the various factors that affect software engineers.

To identify the various factors that affect individuals, HCI researchers have used sensing and tracking approaches to study indicators, such as job strain and stress [53, 66, 105, 120], job satisfaction [56], and happiness [42]. While there has been growing interesting in understanding mental wellbeing from the lived experiences of participants [20, 30, 67], little has focused on the work context. A broader approach to understanding mental wellbeing may reveal additional ways in which mental wellbeing manifests itself through employees' work practices and technology usage.

2.3 Current Solutions to Managing Poor Mental Wellbeing in the Work Context

Several models are popularly used when assessing a mental wellbeing solutions, including Cooper's primary-secondary-tertiary model [22] and the Institute of Medicine's promotion-prevention-intervention approach to mental wellbeing management [119]. These models categorize the types of solutions available for mental wellbeing. Kinmay [66] found that organizations and employees typically use secondary and tertiary solutions, which closely aligns with the promotion and intervention stages of the Institute of Medicine's approach. A primary or prevention solution addresses sources of poor mental wellbeing before it manifests; a secondary or promotion solution aims to increase awareness and one's understanding of mental wellbeing; and a tertiary or intervention solution focuses on reducing symptoms of poor mental wellbeing.

In recent years, addressing employee mental wellbeing has become a core initiative for many organizations [124]. They have tried to address this issue through improved mental wellbeing related benefits, both as prevention and intervention, such as an increase in paid time off (PTOs) and vacation [27, 69, 109], financial support for wellbeing related activities [109], and enhanced insurance plans with employee assistance programs (EAPs) and mental health services (e.g., counseling) [37, 71, 124]. Furthermore, as many organizations evolve to permanent remote or hybrid working, they are also addressing factors that specifically impact remote workers such as providing flexible work schedules and organizing social events to counteract a lack of social interactions [54, 80]. Larger technology organizations are moving beyond mere policy changes by addressing the nature of work itself. For example, Microsoft urged their leadership teams and other organizations to rethink productivity metrics to include employee wellbeing, aiming to lessen the productivity pressure felt by employees [36].

Employees are also using technologies to manage mental wellbeing at work. These solutions typically help employees in one of two ways: (1) stress-sensing and (2) delivering mental wellbeing intervention and coping mechanisms. For example, smartwatches and other wearable technologies [5, 39, 98] are now equipped with heart rate sensors that allow workers to assess their stress levels and initiate action to alleviate stress [17]. Mindfulness activities and cognitive behavioral therapy (CBT) interventions are typically delivered via standalone mobile applications (e.g., Headspace [50] and Calm [16]) or embedded within the tools commonly used by employees (e.g., Microsoft Viva Insights [79]). Through the use of cameras and other body movement sensors, recent HCI research started to explore identifying the right moment at work to delivery stress-reduction solutions [2, 53, 105]. Some organizations further encourage their employees to use mental wellbeing mobile applications by reimbursing their purchases of those applications [89].

Despite these organizational efforts to improve mental wellbeing, many employees feel these efforts are insufficient and often not useful [37, 84]. Therefore, the use of organizational policies and initiatives remains low [44]. This is in contrast with the positive viewpoint that organizations have on the mental wellbeing policies they provide [37]. Additionally, user engagement and adherence continue to be a challenge for mental wellbeing mobile applications [13]. Although there is growing interest in using persuasive designs to increase user engagement, a recent study also found that it can hinder the positive impact of mental wellbeing mobile applications. Specifically for applications that focus on using mindfulness to reduce poor mental wellbeing symptoms, attempts at persuasive designs such as daily streaks turned the need-based intervention into a daily mundane task [61].

2.4 Software Engineers and Mental Wellbeing

In early 2022, the Great Resignation prompted workers in two major industries – healthcare and technology - to resign due to increased job demands and burnout rates [21]. Within the software engineering field, 20 percent of software engineers across the globe were actively looking for new opportunities, prioritizing their experience at work [86]. Compared to many other professions, software engineers in the U.S.A have a high employee suicide rate [18], and 83 percent of the surveyed software engineers in the United Kingdom constantly experienced burnout at work [3]. Researchers have found that some software engineers use substances such as cannabis to increase concentration and induce comfort [26, 29], which can lead to a variety of problems when when overused. Additionally, software engineers' poor mental wellbeing sometimes leads to low code quality and process adherence [42] that can directly affect products used in high-risk industries such as healthcare.

Another way to consider the work of software engineers and how it relates to mental wellbeing is through the JDCS model as described in Section 2.2. According to the model, a high strain job has high demand, low control, and low social support, which leads to increased risk of experiencing poor mental wellbeing [46, 49, 60]. Although we were unable to find past studies that directly assessed the work of software engineers along the JDCS model's spectrum, we can infer that software engineering is high strain based on prior studies conducted on the everyday work of software engineers [45, 77, 78]. It is high demand because it is tool-intensive and technology-reliant [6, 101], especially because software engineers face constant changes in product requirements and user needs [23], and because most of their work is performed via technology (e.g., coding, project management, code review). Their work can also be considered low control because software engineers often are interrupted in their individual focus time and must juggle getting their own work done with frequent meetings with collaborators [78, 125], *"resulting in highly fragmented work"* [78]. While the recent increase in hybrid and remote work [102] allows for work

schedule flexibility, which increased job control [35], it also increased job demand by pressuring employees to be responsive over instant messages. At the same time, it reduced social interactions with colleagues [35]. Thus, their work also has low social support. By better understanding the work of software engineers and their mental wellbeing management challenges, we can be informed on future technology designs that support not only software engineers' mental wellbeing but also other professions that are considered high strain.

2.5 Summary

While a growing body of research exists to examine mental wellbeing in the work context, a number of open questions remain about the challenges and barriers employees face in addressing their mental wellbeing. Consequently, this study has three primary research questions:

(1) How does mental wellbeing manifest itself at work for software engineers?
(2) What challenges and barriers do software engineers face with current company policies and digital solutions for mental wellness?
(3) What do software engineers expect from technology for managing mental wellbeing?

3 METHODS

We conducted 14 semi-structured interviews with software engineers from in the U.S.A. The interview were transcribed and analyzed. The next few subsections describe our recruitment process, data collection and analysis methods, and the ethics we followed for asking mental wellbeing related questions.

3.1 Recruitment and Participants

Participants were primarily recruited through LinkedIn. Using convenience sampling [33]. The research team posted the study on their professional network to recruit the initial participants. We then asked the initial participants whether they would be willing to refer additional participants to our study (i.e., snowball sampling [33]). Participants were eligible for this study if they were: (1) self-identified as a software engineering professional, (2) U.S.A based, (3) English speaking, and (4) over the age of 18. We recruited a total of 17 participants, but 3 of them either did not meet the eligibility criteria or were unavailable to participate. In the end, we conducted semi-structured interviews with 14 participants, of which 5 were female, and 9 were male. All participants worked for different companies and ranged from entry-level developers to managers. Table 1 further summarizes the demographics of our participants.

3.2 Data Collection and Analysis

All interviews lasted approximately 45 to 60 minutes and were conducted over Zoom by the first author. Participants were asked a series of open-ended questions regarding their experience with mental wellbeing at work, strategies used to manage mental wellbeing and coping mechanisms for poor mental wellbeing, the impact of poor mental wellbeing on work, and company policies that aimed to support employee mental wellbeing. With the participants' consents, all interviews were recorded in video and audio. All audio was transcribed by Zoom using the live caption feature during the session. Both the text file of the live caption and the audio recording were then saved only locally on a password-protected device. The transcripts were then anonymized, reviewed, and further edited by the interviewer to ensure accuracy by comparing them to the audio recordings. All participation was voluntary and the participants did not receive monetary compensation for their participation.

To analyze the interview data, we used inductive open coding [97]. The first two authors were the primary coders and frequently consulted with the rest of the research team for feedback, following the coding process for multiple coders as suggested by Hill et al [52]. We first independently open-coded two transcripts and compared our codes to develop a codebook with codes such as "definition of poor mental wellbeing", "coworker's communication", and "repeated occurrences of poor mental wellbeing". After three iterations, we finalized our initial codebook. Subsequently, each researcher coded three different transcripts individually and these were jointly reviewed and discussed to gain consensus on the codes used, as well as any new codes or modifications to the codebook. The two researchers then repeated the process of coding three transcripts and reviewing their findings weekly until all transcripts were coded. We also collected memos relevant to the research questions, and discussed and resolved disagreements along the way through open dialogue. After all transcripts were coded, the two researchers grouped relevant codes to identify themes based on the research questions. These include mental wellbeing at work, contributing factors to poor mental wellbeing, impact of poor mental wellbeing, and unsuccessful strategies. The preliminary themes were then discussed with the other members of the research team and a final set of themes were developed through that discussion.

3.3 Ethics and Data Privacy

This research was approved by the Institution Review Board of the research team's university. This included gaining verbal informed consent from each study participant at the commencement of the interview. All recordings were stored securely on an encrypted device accessible only to the researcher conducting the interviews. All personal data (i.e., names, company names) was anonymized before the transcripts were uploaded onto a secure University drive accessible only to the researchers involved in this study. Each recording was deleted once it had been transcribed.

Mental wellbeing can often be a difficult subject to discuss and participants may experience discomfort disclosing certain experiences. When conducting our interviews, we were mindful of aspects that build rapport including validation, reflection, and other active listening techniques. For example, we acknowledged that it could be difficult to disclose mental wellbeing challenges at work and we thanked our participants for sharing their experiences with us throughout the interview. We also ensured that participants had control and autonomy to decline to answer any question, while feeling comfortable asking the researchers to remove certain responses from the record if desired.

3.4 Researcher Reflexivity

Our research team consists of experts in software engineering, clinical psychology, and HCI. Both the first and second authors have

Table 1: Participant Demographics

Participant ID	Gender	Job Title	Years in Field	Company Size
P1	Female	Associate Software Engineer	3	Medium
P2	Male	Product Manager	15	Small
P3	Male	Senior Software Engineer	17	Medium
P4	Female	Principal Product and Technical Program Manager	26	Large
P5	Female	Backend Software Engineer	5	Large
P6	Male	Chief Development Expert Officer	12	Large
P7	Male	Senior Software Engineer	17	Large
P8	Male	Director of Product Management	25+	Medium
P9	Female	Senior Software Engineer II	6.5	Medium
P10	Male	Full Stack Engineer	2.5	Large
P11	Male	Principal Engineer	13	Medium
P12	Male	Software Engineer	3	Medium
P13	Male	Software Development Engineer	2	Large
P14	Female	Backend Software Engineer	3	Large

experience working with software engineers in the industry, with the second author has worked extensively as an associate software engineer and a manager. The multidisciplinary nature of the team allowed us to create an interview protocol that was tailored to software engineers and considered terminology that was unique to their work. It also helped establishing rapport with our participants more easily. For example, we asked about "work practice" and "the way you write code" instead of using the term "process". Because the first author worked in the technology industry, they were able to connect with the participants in the interview sessions by having a shared understanding of jargon such as "standups" and "agile". In the data analysis phase, the second author leveraged their background as a software engineer to provide additional insight. Their familiarity with the rhythms and stressors of software development activities helped in the coding, resulting in a meaningful codebook with its resulting set of themes. Other authors who were not software engineers also consulted on data analysis, which helped reduce potential bias of the first two authors and allowed the team to understand the data from different perspectives.

4 FINDINGS

In this section, we present software engineers' mental wellbeing experiences at work and the various strategies they employ to manage mental wellbeing. However, because existing management strategies have their limitations, we also highlight some common challenges encountered by our participants at the individual and organizational levels. We conclude this section by describing some ideas for technological solutions suggested by our participants.

4.1 Manifestation of Poor Mental Wellbeing at Work

In this section, we describe indicators of and contributing factors to poor mental wellbeing at work and strategies used to manage mental wellbeing based on our participants' lived experiences.

4.1.1 Indicators of and Contributing Factors to Poor Mental Wellbeing. Poor mental wellbeing manifests through varying indicators, many of which are affective, though some are physiological. Affectively, poor mental wellbeing appeared as fleeting moments such as "*frustrat[ion] [that] goes away*" (P3) or "*cumulative*" (P5) feelings that eventually led to participants experiencing "*burned out*" (P1). Many participants also felt "*really stressed*" (P4) and "*some anxiety*" (P5, P7) at work. Several participants also associated emotions such as anger and "*unpleasantness*" (P2) with poor mental wellbeing. For example, P8 expressed that when they were "*not recognized for the work that [they] did. Like, that piss [them] off*" (P8). Physiologically, it appeared as behaviors such as "*grinding [their] teeth*" (P11) and "*getting dizziness [...and...] headaches*" (P2). A few participants further elaborated on how they felt when experiencing poor mental wellbeing at work: "*more like kind of on the edge*" (P3) and "*not in the right headspace*" (P11). Interestingly, the typical indicator of poor mental wellbeing, stress, is not always viewed as a negative experience at work. For example, P13 described their appreciation of "*the stress [that] comes with the technical challenge*" (P13). Also, an optimal amount of stress and "*reasonable stress, maybe even good stress*" (P8) are motivating to some participants. Furthermore, poor mental wellbeing was experienced at a group level, influenced by each other's emotions and behaviors: "*when we were stressed like, we were generally stressed together*" (P5). This suggests that poor mental wellbeing not only manifests at the individual level, but also at a team level.

Our participants revealed different factors leading to poor mental wellbeing at work. For example, participants described situations beyond their control, including urgent deadlines and changes made by stakeholders that resulted in wasted time on development work: "*we will get done with a story [i.e., task or part of a feature] or will be building a story, and two weeks later will rip out that feature*" (P10). Some participants talked about "*pressure to like always be on for Slack*" (P1), self-doubts, and concerns over performance and job security as contributing factors to their poor mental wellbeing: "*No one has said anything – but I worry a lot about like, am I going to have like a negative performance review and be fired*" (P14). In addition to these factors, our participants listed other common contributing factors as highlighted in the related work section, such as long work

hours, lack of autonomy at work, and communication challenges with colleagues.

4.1.2 Strategies for Managing Mental Wellbeing. To address the challenges of mental wellbeing at work, participants leveraged different strategies to prevent poor mental wellbeing from manifesting at work, and to cope when it had manifested. We identified four main strategies: (1) protect personal time, (2) prioritize work, (3) learn about mental wellbeing, and (4) find social support. Participants often relied on organizational policies and technology to help facilitate those strategies.

Personal Time. Participants strived to balance work and personal time. Many of them created to-do lists and "*allocate[d] time for focusing on [their] calendar*" (P2) to ensure their personal time was protected from work tasks, often done digitally using Outlook's calendar. Participants also took regular breaks, which typically were in the forms of "*watch the clip here and sit down, maybe read, read some articles*" (P8), "*go for a drive*" (P11), and "*take my dog for, like, a 10 minute around the block*" (P10). They felt that by doing so, they not only had a chance to "*escape the office*" (P2), but also "*clear [their] head, stretch [their] legs and just basically disconnect*" (P10). For longer breaks, participants leveraged organizational policies such as "*company days off*" (P3) to "*recharge*" (P3) mentally.

Prioritize work. As a coping mechanism, some participants prioritized work activities over other activities because they wanted to address the contributing factor of poor mental wellbeing. In particular, when poor mental wellbeing stemmed from factors beyond their immediate control, such as urgent deadlines, they felt that they "*had no choice but to try and like push through it*" (P1). One participant claimed that "*I'm just focused, focusing on... anything that will cause my stress, instead of just wrestling with the stress itself*" (P13). In addition to addressing the direct contributing factor of poor mental wellbeing, some participants prioritized other work responsibilities as a distraction: "*So when I shift my focus to work on the junior member [e.g., troubleshooting junior members' codes and resolving junior members' struggles at work], whatever I work on and get me frustrated, attend to nothing about it*" (P7). In these circumstances, focusing on work not only helped address the potential causes of poor mental wellbeing, but also acted as a distraction from the negative feelings participants had at the moment.

Continuous learning. Our participants typically perceived mental wellbeing as an ongoing learning experience. Many of them acknowledged that they "*have never really had a lot of experience in mental health*" (P11), but were becoming more aware of their mental wellbeing at work and ways to manage it effectively. For example, several participants began to take an interest in seeking help from professionals for counseling and therapy (P4, P5, P11). Some also learned and sought advice through social media: "*there's actually so many good like it's weird like on TikTok ...a lot of actually like really good educational content on...like mental health, and all that kind of stuff*" (P1). Over time, participants also learned to avoid potential contributing factors and situations of poor mental wellbeing at work: "*I know if I go this route, I'll be stressed in a month, so I don't want to go this route*" (P3). One participant provided an example where they had experienced poor mental wellbeing when communicating with international teammates in the past, so, they now "*mak[e] sure that [they are] over-communicating, clearly communicating*" (P4) to avoid facing the same situation.

Social support. Participants turned to peers and managers for support. Often, they found comfort in sharing and hearing about similar experiences, and combating the feeling of isolation. When working in person, social support often happened organically. For example, they "*go out and socialize with coworkers over lunch time, which also again also helps you decompress let off some steam*" (P4), and "*in the office like they had this thing...which has like a grand piano and like drums and stuff so like people are like hang out there, and not work*" (P5). Even the mere presence of their teammates helped improve their mental wellbeing at work: "*I need people around me. I may not talk to them. But I would rather [be] in office, and knowing that people [are] around*" (P7). In contrast, when working remotely, "*every single interaction, more or less, it's almost like it needs to be planned*" (P8). Participants sought social support virtually either at social events organized by their organizations, or through messaging and video conferencing technology such as Slack and Discord: "*basically just vent to each other*" (P10) online while "*play[ing] Among Us [i.e., an online game] together*" (P10). Besides turning to colleagues, many participants described how their immediate managers supported them. As one participant noted, "*I have a weekly one on one with my manager. So, just, that's also how I can try and manage stress*" (P8). Another participant recalled how their manager would "*always give [them] a few days off*" (P3) when the participant expressed mental wellbeing concerns. For our participants, coping with challenging situations together as a team was an important part of their mental wellbeing management, perhaps because the social aspect helped show them that they were not alone in the process of mental wellbeing management.

4.2 Challenges to Managing Mental Wellbeing at Work

While participants were aware of and engaged in trying to manage their mental wellbeing, many of them still continued to experience challenges. In this section, we highlight some of the organizational and individual challenges that they identified.

4.2.1 Organizational Challenges. Participants described a set of organizational-level challenges that they encountered ranging from lack of familiarity with policies to organizational culture.

Issues with organizational policies. First, there was unfamiliarity with policies and processes. Generally, many participants assumed their organizations had some sort of policies and resources for mental wellbeing because of the "*silicon valley mentality*" (P11). Participants described this mentality as the idea that technology companies located in Silicon Valley typically have mental wellbeing support for employees, so other technology companies should offer the same. While some participants recalled specific company policies and resources, others acknowledged that they could only name common perks such as PTOs and wellness stipends. Compared to participants who had managerial roles at work, those who were programmers seemed to be less familiar with the specifics of the company policies and resources:

> "*I'm trying to think. I know there is something that you can do for like, I think, I think our health insurance*

> *gives therapy, I'm not sure. I want to say that. That's the only thing I really can think of that our company specifically is doing.*" (P10)

One explanation as to why participants were unfamiliar with specific policies and resources around mental wellbeing is the lack of advertisement and communication about such policies at work: "*I'm kind of sure that they do have processes that I don't think they're super well-advertised*" (P11). In contrast, for the participants who were well-informed on company policies and resources, they typically viewed the company in a positive light: "*I would say my company they did a pretty good job supporting employee*" (P7) and even if they "*haven't used any of those days [crisis leave], but it's nice to have nice to know that you have them*" (P6). The feeling of having a safety net for when they needed support for poor mental wellbeing likely affected their perspective toward organizational policies. It is worth noting that even when participants became familiar with the policies, they may still be "*not really sure where I'm supposed to get started with that policy*" (P13). This presents another challenge to using these policies.

Second, many participants were skeptical and questioned the policies' long-term benefits and the organizations' alternate agenda with mental wellbeing policies. For example, participants hesitated to leverage PTOs that were meant for recharging for mental wellbeing. While they wanted "*more vacation to allow for that mental checkout*" (P4), they also expressed concerns:

> "*while you could work on getting time off...the work was still there when you came back. And so when you came back, you felt more stressed because then you were catching up.*" (P4)

A few participants were also skeptical towards the organizations' intentions of implementing mental wellbeing policies at work. They questioned whether the organizations actually cared about employee mental wellbeing: "*[organizations] can kind of disguise*" (P1) employer-focused policies (e.g., data-tracking and money-saving) as mental wellbeing support for employees. Another skepticism centered around data privacy. For organizations who currently offer support such as EAP and hotlines, participants expressed concerns over whether their organizations would have access to their data. One participant noted that they "*will state my paranoia that the company is paying for that [hotline] and therefore, how do we know where the reporting is going to*" (P2). In sum, when participants were concerned about the potential negative outcomes of company policies, they seemed to view such policies as unhelpful and were unlikely to use them as support for their mental wellbeing.

Team versus company cultures. Differences between the immediate team and broader organizational culture for mental wellbeing affected participants' attitudes towards the company support available. Many participants felt that they had a supportive team, but an unsupportive organization. As noted earlier, participants recalled instances when their managers were supportive of their mental wellbeing management at work. For example, they took initiative to encourage participants to take breaks and worked with participants to identify effective management strategies. However, participants wanted to see this in the broader organizational culture, not just in their own teams. Particularly when remote work dominated the industry and in-person collaboration was not possible, managing mental wellbeing felt "*more just on us [employees] now*" (P10). They wanted to see mental wellbeing as something "*the company should embrace...unlike you know a group level*" (P11). Another participant also commented on how company culture affected their perception on mental wellbeing:

> "*you can put in whatever practices you want, or have whatever resources, but if I know that like if I came out about dealing with something and that all of my peers weren't going to be accepting of that or looked down upon that then, like, how would I ever be incentivized to do that.*" (P12)

The direct comparison between their teams and their employers affected participants' perceptions towards their company - they often felt that their broader company culture around mental wellbeing was not as strong as their team culture.

4.2.2 Individual Challenges. Participants also described a set of individual-level challenges, including their perceptions and attitudes towards mental wellbeing and issues with mental wellbeing technology.

Attitudinal challenges. Participants acknowledged that it was ultimately their own responsibility to manage their mental wellbeing. Yet, many of them struggled to prioritize mental wellbeing management because of attitudinal challenges. By attitudinal challenges, we are referring to the fact that participants had specific thoughts and beliefs about issues related to managing mental wellbeing, namely the time commitment, cost, and efficacy of mental wellbeing solutions. Some expressed that "*I don't feel like I have time*" (P9). Particularly, when participants were in an overall comfortable mental wellbeing state, they felt that their time could be spent elsewhere: "*I just kind of stopped doing it. You know like you have so much time in the day, it's easy for stuff like it – I think it's easy for stuff like that to get deprioritized when, when you're feeling good right?*" (P12). In contrast, for participants who shared their successes in managing their mental wellbeing through mental wellbeing technology and other means, finding time was less of an issue:

> "*Let's say I have a 15 minute break or so I could say oh no I do this 12 minute. Or what I sometimes did in the past, I sometimes traveled with an Uber or Lyft to office, and sometimes it was just very early in the morning and it was still dark outside and nothing exciting to watch.*" (P6)

Additionally, some participants expressed caution in subscribing to mental wellbeing mobile applications that required payment to unlock full services. For example, one participant described their preference for a free, university-based mobile application over other popular ones on the market: "*It's, um, it's actually, it's actually the nice thing it's free, because of I wasn't really willing to, willing to spend money*" (P6). And another said that because their company offered them "*free subscription to Calm, that's why I tried it*" (P4). For one participant, the cost of a mental wellbeing technology was the reason they ended up not choosing to use the technology, especially coupled with the uncertainty of its efficacy:

> "*I mean I was considering, you know, doing that ridiculous amount of money, $200, $300, $400 for the, the special Muse...that you try it to your meditation session...That's a lot of money for a device that may or may not work.*" (P2)

Interestingly, participants' attitudes toward the efficacy of mental wellbeing technology also apply to free applications. One participant described their experiences with Microsoft Office Insights, where users are informed about their time spent in meetings, on emails, and more; they stated that while "*it's an interesting attempt,*" (P8) they "*haven't found that, that useful yet*" (P8) because they were "*not quite sure what to make use, what to do with the information that provides. Not very actionable in my opinion*" (P8). In order for participants to justify spending time on managing mental wellbeing and paying for mental wellbeing technologies, they had to believe in the values of various interventions and technologies for mental wellbeing management.

Mental wellbeing mobile applications lack social interaction. As mentioned in an earlier section, shared experience is important for participants to cope with poor mental wellbeing. When describing their experiences with mental wellbeing technologies, especially mobile applications such as Headspace and Calm, many participants criticized modern mental wellbeing technology as being an isolated experience. One participant compared their mental wellbeing technology experience to the differences between using a fitness application and going to the gym:

> "*I may not know the people in the gym, but I rather have people around me workout together. So, I did think about using those like yoga apps...But I tried it and then I never use it again. I just don't feel like the same.*" (P7)

Other participants also stated that although they had tried popular applications such as Headspace, they "*sort of hit a block, a brick wall. Doing that by myself, it, you know, it doesn't, it didn't register*" (P2). It is worth noting that this critique primarily applied only to mental wellbeing technologies. As mentioned earlier (Section 4.1.2), participants found other tools and technologies to be facilitative in social interactions, namely Slack and Discord for chatting with friends and peers to cope with mental wellbeing challenges.

Technology fatigue. Even though most participants had no issue with using entertainment technology for relaxation, some cited technology fatigue as a reason for not using mental wellbeing technology. Because our participants were software engineers, it was common for them to have high screen time at work. For example, coding, collaboration, and project management all took place through computers and monitors, especially when working from home. One participant expressed that "*when I need to relax, the last thing I want to do is pop on the camera and do yet another thing on my computer or my phone*" (P4). Another participant also shared the sentiment: "*I'm a tech guy I'm working as a tech guy. So in my free time, just try to be away from the tech*" (P13). As a result, when the solution to mental wellbeing management required participants to look at a phone screen for additional time outside of their work, they felt that it was an added burden, which was another challenge to using mental wellbeing technology.

4.3 Technologies for Mental Wellbeing at Work

In our interviews, we asked participants whether they had any potential solutions to address mental wellbeing at work. Despite wanting to be away from technology, some participants felt that technology could nonetheless help. For example, they believed that automation and passive sensing could be implemented to support employee mental wellbeing, such as technology that can analyze and predict an employee's mental wellbeing based on employee work data:

> "*I read about research even the tone of voice, there's, there are pretty good, machine learning models that basically can predict if someone is depressed or even susceptible to suicidal thoughts by just analyzing the voice.*" (P6)

Similarly, personalized assistants "*like a Siri or something that they could, you know, help you under–understand, you know, why your heart rate is elevated or something*" (P11). The participant further elaborated on how a digital assistant at work could also "*give you a little pep talk*" (P11) so they would "*have that kind of [supportive] person that's always in your corner*" (P11). Another participant raised the idea that a software application can also "*block you [from doing work]... maybe at noon it's like okay, you're supposed to take a break*" (P9) and would not allow one to resume work until a break has been achieved. It is important to note that participants also emphasized the importance of privacy rules and user autonomy, especially ensuring that the application "*wouldn't force you to do something*" (P9). These ideas help offload the responsibility to recognize poor mental wellbeing to technology.

In addition to creating innovative tools at work to help manage mental wellbeing, participants also suggested changing their current work tools to be more social. As described earlier, social support was an effective way to cope for our participants, even when participants were merely present in the same space. However, remote work settings removed many social experiences that were once a part of in-person collaboration and participants longed for updating technologies at work to bring back togetherness. For example, P3 remembered how they "*would go up to your coworker and say hey, Let's open this up and let's review it*" (P3) and wished there was a tool for "*more interactive pull requests*" (P3) where they and their coworkers would be able to work on it simultaneously. Another participant expressed wanting better brainstorming technology that could provide the "*same experience for a bunch of people to just get into a room and kind of just spitball with a whiteboard*" (P4) as they found existing solutions lacking. Additionally, participants expressed the importance of talking about mental wellbeing at work with each other. They suggested leveraging existing technology to foster such communication. For example, having a "*never ending Google Docs*" (P3) helped P3 to self-reflect and bring up mental wellbeing challenges with their manager. Similarly, P14 wanted a way to track their personal goals and contributions to share with their manager and the higher management: "*I do a lot of emotional labor, and that doesn't it doesn't count for anything on my team as far as like um, career growth*" (P14). As a result, work technologies can play a role in facilitating team-based conversations about employee mental wellbeing.

5 DISCUSSION

Our findings highlighted the different ways that poor mental wellbeing manifested itself relating to the work of software engineers, our participants' strategies for coping with it as well as fostering positive mental wellbeing, their challenges in managing mental wellbeing, and ideas for mental wellbeing technologies at work. In this section, we first discuss the importance of understanding the nature of work when studying mental wellbeing at work. We then turn our attention to how mental wellbeing at work is a multi-level challenge, that spans the individual, team, and organization. We conclude this section with some thoughts on integrating mental wellbeing directly into the technologies that software engineers use for work. Particularly, we focus on discussing future design opportunities that can foster social support at work and facilitate mental wellbeing conversation at the team and organization levels.

5.1 Mental Wellbeing at Work

Increasingly, both organizations and employees have become more aware of the importance of discussing and managing mental wellbeing at work. However, we are still in the early stages of understanding how poor mental wellbeing manifests itself at work. For example, our study suggests that while current research has focused on stress and its management [53, 66, 105, 120], software engineers described additional indicators of poor mental wellbeing that include affective feelings such as frustration, anger, dissatisfaction, and unhappiness, and physiological changes such as headaches and muscle tension. Stone [109] also suggested that for software engineers, poor mental wellbeing can manifest itself as a feeling of emptiness, or employees questioning their purposes of work. Similarly, Smith [104] studied the work of nurses and found that poor mental wellbeing manifested as both stress and physical fatigue. Additionally, different professions may have varying levels of expectations of the thresholds for what constitutes poor mental wellbeing. For example, the JDCS model [60] suggests that job roles with high demand, low control and low social support typically lead to worsened mental wellbeing; however, our study reveals that while software engineering fits the JDCS high strain profile, some software engineers appreciated and enjoyed the challenges that came with the job and understood that their work came with a considerable amount of stress. Raizada [91] compared this idea to physical injuries, where he stated that academic scholars may expect anxiety and depression to be part of their work much like how athletes expect injury as a result of their work. However, as Raizada [91] pointed out, it is important to identify when it is too much and have preventive measures in place for that tipping point. Consequently, we need to identify factors that lead to poor mental wellbeing based on the context of the particular profession.

Additionally, it is common for employees to experience a spillover effect of poor mental wellbeing at work, where emotions and behaviors experienced at work are carried over into daily life outside of work [8, 47]. Similarly, the opposite is true when mental wellbeing challenges from personal life are brought into work [8, 47]. Prior to the adaption of remote work, our participants mentioned that software engineers were responsible for being on-call occasionally, which required them to be available all day by phone, being vigilant of any emergencies that could arise and resolving them as soon as they could. This means "work" includes not only the work done at the employees' work offices, but also at their homes. The increased implementation of remote and hybrid work further blurred the lines between work and personal life. Because this has been a known concern, organizations have leveraged technologies to mitigate productivity and collaboration challenges. However, these technologies have become a part of their work and we argue that organizations and the developers of those technologies have not considered the impact these technologies have on employees' mental wellbeing. For example, Slack and Zoom can be used to increase socialization and team collaboration. But at the same time, our participants felt that being on Slack meant they felt pressured to always be available and responsive to their teammates' requests and vice versa because of the instantaneous nature of Slack messaging. This shows that it not only adds to the blurred line between work and personal time, but also increased interruptions at work and constant reminders and pressure of deadlines. As new virtual workspaces such as Horizon Workrooms [90] gain traction among organizations with remote employees, it will be crucial for the HCI community to be sensitive to what mental wellbeing means in these new work environments and technologies.

However, we also found that technologies used for work tasks can also help manage mental wellbeing. For example, shared Outlook calendars allowed participants to schedule meetings with each other and be aware of each other's focus time, helping participants gain control over their work schedule. This in turn reduce the chances of poor mental wellbeing manifesting as a result of coordination challenges and frequent context switching. As new tools and technologies are added to employees' work routine [6], it will be important to examine how individual's interactions with technologies affect their mental wellbeing.

5.2 Mental Wellbeing as a Multi-Level Challenge

A variety of different factors contribute to an individual's sense of mental wellbeing. HCI scholars and social scientists have studied mental wellbeing through the lens of the social ecology model [82, 110], which highlights the importance of considering interactions between different ecosystems of an individual, including their microsystem, mesosystem, exosystem, macrosystem, and chronosystem [14]. These ecosystems represent the individual, their immediate social circles, communities, the society, social and cultural values and beliefs, and changes that happen over time. As shown in Figure 1, we found a similar structure for mental wellbeing at work in this study; participants did not look at mental wellbeing at work as purely an individual issue but instead saw it at multiple levels – individual, team, and organization. Furthermore, employee mental wellbeing is affected by the interaction of multiple factors [48]; therefore, as Ng and Fischer state, *"wellbeing should also be understood in multiple levels simultaneously"* [83]. While our study found similar contributing factors to poor mental wellbeing as prior studies [48, 51, 73, 87], we also observed interactions among the individual, team, and organization levels (Figure 1). For example, our findings suggest that having a positive team dynamic helps counteract the negative impact of organizational factors that typically lead to poor mental wellbeing at work, such as heavy workload as

a part of the job demands. Individual factors such as personalities and past experience with challenging situations affected employees' perspectives on how problematic factors at other levels may be. Similarly, Tokdemir found that sleep quality (an individual factor) affected how much workload (an organizational factor) could influence employee mental wellbeing [117], suggesting an interaction between individual and organizational factors. Conversely, having an unsupportive manager or team members (an organizational factor) contributed to self-doubts (an individual factor). These interactions highlight that the various levels are not isolated from each other but rather are closely tied to each other. Consequently, when we are designing solutions to address mental wellbeing, we must account for these interactions.

Besides observing contributing factors across the individual, team, and organization levels, both our study as well as other research [45, 60, 66, 88] suggest that the mental wellbeing management is a shared responsibility across these three levels. This means individual employees, their colleagues, supervisors, and the senior leadership at the organization need to work with each other to promote mental wellbeing, as well as prevent and intervene poor mental wellbeing. Currently, this has not been done well based on our participants' recollection. For example, when participants described how they did not leverage organizational resources for mental wellbeing because of a lack of awareness, not only the individual employee has the responsibility to seek out those resources but also the organization needs to improve communication and advertisement of such resources. Additionally, many of the current strategies and solutions primarily assume individual responsibility and do not support team-based or organization-based mental wellbeing management, including many mindfulness applications that require employees to take responsibility to initiate care for themselves. However, there is a growing focus on understanding these interactions. For instance, while a recent personal sensing study recommended breaks based on employees' work schedules, the researchers also suggested a team-centric approach [62]. This could be recommending breaks at a team level based on multiple team members' availability and work patterns, further facilitating the social support an employee needs for managing their mental wellbeing at work. In sum, any changes to the management at one level has to also be evaluated as to its impact at the other levels and account for the interactions amongst these different levels.

5.3 Integrating Mental Wellbeing into Work Technologies

By incorporating mental wellbeing management as part of employees' regular work practices, we can start to address challenges raised by our participants, such as motivation, time commitment, and the spillover effect. To address these issues, organizational and policy changes that support mental wellbeing are crucial [45]. However, their implementation can be complex and time-consuming. While organizational processes and policies can influence employees' behaviors and attitudes toward mental wellbeing and its management, technology can also influence individuals' or teams' behaviors and beliefs [59]. As a result, we discuss ways to rethink technologies at work that integrates mental wellbeing into individual work practices, and team and organizational cultures. In our findings, we highlighted how employee's mental wellbeing experiences are impacted by the technologies they use to complete work tasks. Boivie et al. suggested that software development processes need to take users' health and psychological wellbeing into consideration [11], particularly the job demands, control, and social support users may have at work. Similar to software accessibility features such as varying font sizes and ensuring keyboard ease of use, mental wellbeing should also be considered when designing and developing work tools. Furthermore, as accessibility has been brought more formally into the design and evaluation process for tools, [12], we need to consider how to also include mental wellbeing more formally in the process. Meanwhile, mental wellbeing management at work needs to be continuous, supporting not only intervention and prevention of poor mental wellbeing, but also promotion of general mental wellbeing [104].

One approach is to improve features to prevent known contributing factors from impacting employee wellbeing. This can be by reducing job demands such as the need to always be online and responsive, and increasing control and autonomy. A recent example is incorporating smart technologies that evaluate the number of recent notifications and recommend muting or continuing to mute notifications [15], so that instant messaging tools do not interrupt workers' workflow or demand employee's constant attention for messaging requests.

The promotion of mental wellbeing and its management can also be integrated into work technologies. Promotion can include education around mental wellbeing and potential management solutions for poor mental wellbeing. It can also mean increasing discussion around mental wellbeing and reducing stigma at work. As we discussed earlier, mental wellbeing is a shared responsibility across the individual, team, and organization, so promotional efforts need to exist at all levels. For example, on a team level, Rico [93] suggested performing reflexive activities regularly for emotion regulation. Similarly, Rich's study integrated group discussions on mental wellbeing into doctors' workflow and found it to be effective in promoting and managing mental wellbeing [92]. We argue that technology can help. For software engineering specifically, our participants mentioned that they follow the agile process, in which they and their team perform daily check-ins for their technical projects (i.e., stand-ups) and complete a reflection meeting (i.e., retrospective) after every project release focused on project improvements [7]. They often use technology (e.g., Standuply [107] and TeamRetro [111]) to guide these conversations. As a result, features such as including mental wellbeing check-in questions and guidelines can be incorporated directly into these technologies to help guide mental wellbeing conversation. Similarly, technologies used for setting performance goals and one-on-one check-in agendas can also include similar guiding questions.

As for integrating intervention into work tools, recent efforts have been made by both industry and academia. For example, Github's Good Day Project [57] and Microsoft's Viva Insights [79] both experimented with embedding mood tracking and daily reflections into the technologies software employees use on a daily basis. They also developed features that prompted employees to schedule focus time on their calendars. Specifically, daily reflection had a high completion rate among employees and showed promises in helping employees understand their mental wellbeing states and

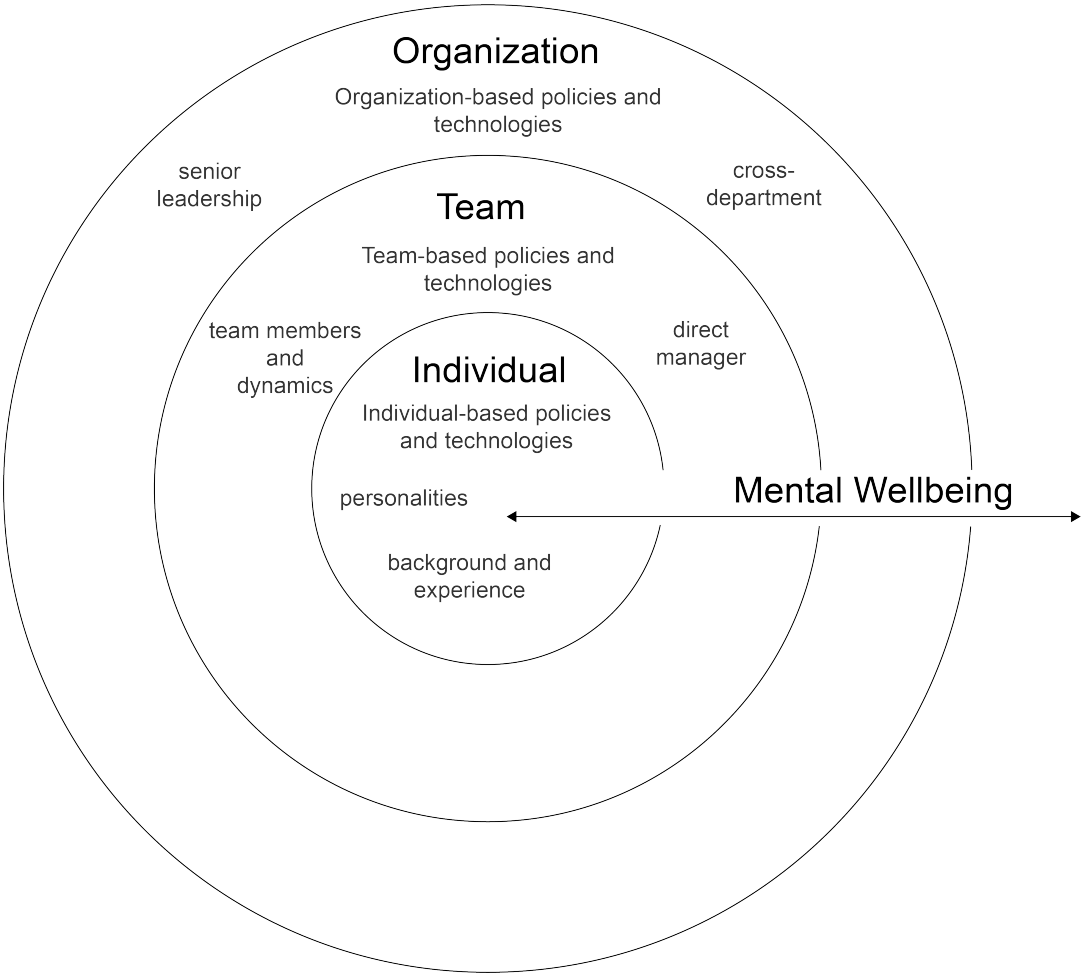

Figure 1: Mental wellbeing across individual, team, and organization levels and factors at different levels.

evaluate aspects of work that contributed to their poor mental wellbeing [57]. Similarly, one of our participants described their use of Google Docs, a common work tool, for daily reflection. They found relying on a tool they already used to be convenient. Additionally, chatbots have been used as personalized mental wellbeing management assistance to encourage mindfulness practices and other evidence-based techniques (e.g., CBT) [53, 122], along with other stress-sensing solutions and just-in-time interventions to provide intervention suggestions at the appropriate time [53, 70, 121]. Participants in these studies also self-reported improved mental wellbeing post-intervention.

Finally, it is important to consider various ethical concerns that come with introducing mental wellbeing data into work technologies. Currently, organizations often track employee productivity through data collected from tools they use and people have questioned the ethics with regards to employee privacy [58]. Considering the sensitivity of employee mental wellbeing data, conversations about the ethical implications of using personal sensing for wellbeing data and integrating mental wellbeing intervention into work tools also need to take place. Our participants already described concerns about data access and privacy. Other studies have also raised similar concerns over sharing personal sensing data with supervisors, especially when power dynamics and job security may be at play [1, 46]. As a result, future designs should consider potential ethical and privacy concerns and allow for user control and autonomy.

6 LIMITATIONS

This study involved participants solely from the U.S.A so U.S.A specific work practices, culture, and societal expectations influenced the participants' experiences of mental wellbeing. As such, our findings may not be applicable to other countries with different cultures and work norms. Our sample size is limited and lacks representation from a more ethnically diverse population. However, as an exploratory interview-based study, the goal is not to generalize to a broad audience but rather to provide insight into issues that warrant broader investigation [9]. Future studies should expand the number of participants and recruit purposefully from less represented populations such as the Latine and Black populations.

Finally, our focus was on a particular type of worker, software engineers, so, their perspectives on poor mental wellbeing may not be reflective of the challenges faced by workers in other domains.

7 CONCLUSION

One of the keys to developing effective mental wellbeing management strategies and support at work is to understand the issues and challenges that employees face in dealing with mental wellbeing. Our study focused on understanding the lived experiences of software engineers in terms of their mental wellbeing. Software engineers represent a subset of information workers known to experience high burnout at at work [3] whose work also aligns with the high strain profile in the JDCS model. Our findings suggest that mental wellbeing at work manifests across different levels: individual, team, and organization; each level has its own factors that can lead to poor mental wellbeing as well as potential solutions. The interplay between the levels adds further complexity to the management strategies. We encourage future studies to examine the cross-level challenges and how to address them. Additionally, mental wellbeing management is more than stress reduction; the mental wellbeing continuum suggests that mental wellbeing management includes prevention, promotion, and intervention. To contribute to the conversations in the HCI field about addressing mental wellbeing at work, we highlight the need for designing mental wellbeing into the everyday work technologies that employees use that support prevention, promotion, and intervention. Addressing poor mental wellbeing in the workplace is a complex and difficult task. However, if we do not develop effective technological and organizational solutions to this problem, the consequences to employees and organizations will increase both in terms of poor employee health and lost organizational productivity.

ACKNOWLEDGMENTS

The research was funded in part by the National Institutes of Mental Health (P50MH119029). We also thank our participants for their involvement in our study, as well as Melissa Mazmanian and Hannah Studd for their feedback on our paper.

REFERENCES

[1] Daniel A Adler, Emily Tseng, Khatiya C Moon, John Q Young, John M Kane, Emanuel Moss, David C Mohr, and Tanzeem Choudhury. 2022. Burnout and the Quantified Workplace: Tensions around Personal Sensing Interventions for Stress in Resident Physicians. *Proceedings of the ACM on Human-Computer Interaction* 6 (2022), 1–48. Issue CSCW2. https://doi.org/10.1145/3555531

[2] Fatema Akbar, Gloria Mark, Ioannis Pavlidis, and Ricardo Gutierrez-Osuna. 2019. An empirical study comparing unobtrusive physiological sensors for stress detection in computer work. *Sensors (Switzerland)* 19 (9 2019), 3667. Issue 17. https://doi.org/10.3390/s19173766

[3] Junade Ali. 2021. 83% of Developers Suffer From Burnout, Haystack Analytics Study Finds. https://www.usehaystack.io/blog/83-of-developers-suffer-from-burnout-haystack-analytics-study-finds

[4] Mary Jean Amon, Stephen Mattingly, Aaron Necaise, Gloria Mark, Nitesh Chawla, Anind Dey, and Sidney D'mello. 2022. Flexibility Versus Routineness in Multimodal Health Indicators: A Sensor-based Longitudinal in Situ Study of Information Workers. *ACM Transactions on Computing for Healthcare* 3 (7 2022), 1–27. Issue 3. https://doi.org/10.1145/3514259

[5] Apple. 2022. Use Apple Watch to practice mindfulness. https://support.apple.com/guide/watch/practice-mindfulness-apd371dfe3d7/watchos

[6] Marcus Ash, Kagonya Awori, Nancy Baym, Mia Bruch, Jenna Butler, Piali Choudhury, Adam Coleman, Scott Counts, Shiraz Cupala, Mary Czerwinski, Ed Doran, Elizabeth Fetterolf, Mar Gonzalez Franco, Kunal Gupta, Aaron Halfaker, Constance Hadler, Brent Hecht, Brian Houck, Kori Inkpen, Shamsi Iqbal, Sonia Jaffe, Erin Knudsen, Stacey Levine, Siân Lindley, Jennifer Neville, Jacki O'Neill, Kate Nowak, Rick Pollak, Victor Poznanski, Sean Rintel, Abigail Sellen, Neha Shah, Siddharth Suri, Jaime Teevan, Adam Troy, Mengtin Wan, and Longqi Yang. 2022. *Microsoft New Future of Work Report 2022: A summary of recent research from Microsoft and around the world that can help us create a new and better future of work.* Technical Report. Microsoft. https://aka.ms/nfw2022

[7] Atlassian. 2022. Agile Retrospectives. https://www.atlassian.com/agile/scrum/retrospectives

[8] Arnold B Bakker and Evangelia Demerouti. 2013. *The spillover-crossover model.* Psychology Press, London, 54–70.

[9] Ida Bark, Asbjørn Følstad, and Jan Gulliksen. 2006. Use and Usefulness of HCI Methods: Results from an Exploratory Study among Nordic HCI Practitioners. *People and Computers XIX — The Bigger Picture* (2006), 201–217. https://doi.org/10.1007/1-84628-249-7_13

[10] Arpita Bhattacharya. 2019. Designing to Support Teen Mental Health Using Asynchronous Online Groups. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children.* ACM, New York, NY, USA, 723–727. https://doi.org/10.1145/3311927.3325352

[11] Inger Boivie, Stefan Blomkvist, Jenny Persson, and Carl Åborg. 2003. Addressing users' health issues in software development – an exploratory study. *Behaviour and Information Technology* 22, 6 (2003), 411–420. https://doi.org/10.1080/0144929031000162434 7

[12] Toni Bonitto. 2022. An Introduction to Accessibility. https://digital.gov/resources/introduction-accessibility/

[13] Judith Borghouts, Elizabeth Eikey, Gloria Mark, Cinthia De Leon, Stephen M Schueller, Margaret Schneider, Nicole Stadnick, Kai Zheng, Dana Mukamel, and Dara H Sorkin. 2021. Barriers to and Facilitators of User Engagement With Digital Mental Health Interventions: Systematic Review. *Journal of Medical Internet Research* 23 (3 2021), e24387. Issue 3. https://doi.org/10.2196/24387

[14] Urie Bronfenbrenner. 1977. Toward an experimental ecology of human development. *American Psychologist* 32 (7 1977), 513–531. Issue 7. https://doi.org/10.1037/0003-066X.32.7.513

[15] Fabio Calefato and Filippo Lanubile. 2016. A Hub-and-Spoke Model for Tool Integration in Distributed Development. In *2016 IEEE 11th International Conference on Global Software Engineering (ICGSE).* IEEE, Orange County, CA, USA, 129–133. https://doi.org/10.1109/ICGSE.2016.12

[16] Calm. 2022. Calm. https://www.calm.com/

[17] Yekta Said Can, Bert Arnrich, and Cem Ersoy. 2019. Stress detection in daily life scenarios using smart phones and wearable sensors: A survey. *Journal of Biomedical Informatics* 92 (4 2019), 103139. https://doi.org/10.1016/j.jbi.2019.103139

[18] CBS. 2016. These jobs have the highest rate of suicide. https://www.cbsnews.com/news/these-jobs-have-the-highest-rate-of-suicide/

[19] R Kevin Chapman. 2022. Mental Health in the Workplace: A Continuing Conversation. In *Proceedings of the 2022 ACM SIGUCCS Annual Conference.* ACM, New York, NY, USA, 38–38. https://doi.org/10.1145/3501292.3511574

[20] Jing Chen, Lu Huang, and Shuangyan Luo. 2019. Relationship between Job Burnout and Emotional Intelligence Based on "Job Demands-Resources" Model. In *Proceedings of 2019 Annual Meeting on Management Engineering (AMME2019).* ACM, New York, NY, USA, 107–114. https://doi.org/10.1145/3377672.3378044

[21] Ian Cook. 2021. Who Is Driving the Great Resignation? https://hbr.org/2021/09/who-is-driving-the-great-resignation

[22] Cary L. Cooper and Sue Cartwright. 1997. An intervention strategy for workplace stress. *Journal of Psychosomatic Research* 43 (7 1997), 7–16. Issue 1. https://doi.org/10.1016/S0022-3999(96)00392-3

[23] Sandun Dasanayake, Sanja Aaramaa, Jouni Markkula, and Markku Oivo. 2019. Impact of requirements volatility on software architecture: How do software teams keep up with ever-changing requirements? *Journal of Software: Evolution and Process* 31, 6 (2019), 633–655. https://doi.org/10.48550/arXiv.1904.08164

[24] Edward L. Deci and Richard M. Ryan. 2008. Hedonia, eudaimonia, and well-being: an introduction. *Journal of Happiness Studies* 9 (1 2008), 1–11. Issue 1. https://doi.org/10.1007/s10902-006-9018-1

[25] Delphis. 2020. The Mental Health Continuum is a Better Model for Mental Health. https://delphis.org.uk/mental-health/continuum-mental-health/

[26] Jeff Elder. 2022. Buzzkill: Tech companies grapple with workers getting high on the job. https://www.sfexaminer.com/archives/buzzkill-tech-companies-grapple-with-workers-getting-high-on-the-job/article_ef1f4294-0651-5e0b-bfd8-7ac8c1bcb843.html

[27] Jennifer Elias. 2020. Google tells employees to take Friday off as a 'collective wellbeing' holiday during pandemic. *CNBC* (9 2020). https://www.cnbc.com/2020/09/03/google-tells-employees-to-take-friday-off-for-collective-wellbeing.html

[28] Don Samitha Elvitigala, Philipp M. Scholl, Hussel Suriyaarachchi, Vipula Dissanayake, and Suranga Nanayakkara. 2021. StressShoe: A DIY Toolkit for just-in-time Personalised Stress Interventions for Office Workers Performing Sedentary Tasks. In *Proceedings of the 23rd International Conference on Mobile Human-Computer Interaction.* ACM, New York, NY, USA, 1–14. https://doi.org/10.1145/3447526.3472023

[29] Madeline Endres, Kevin Boehnke, and Westley Weimer. 2022. Hashing It Out: A Survey of Programmers' Cannabis Usage, Perception, and Motivation. In *Proceedings of The 44th International Conference on Software Engineering (ICSE 2022)*, Vol. 2657. ACM, New York, NY, USA. https://doi.org/10.48550/arXiv.2112.09365

[30] Jordan Eschler, Eleanor R Burgess, Madhu Reddy, and David C Mohr. 2020. Emergent Self-Regulation Practices in Technology and Social Media Use of Individuals Living with Depression. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA. https://doi.org/10.1145/3313831.3376773

[31] S. L. Ettner and J. G. Grzywacz. 2001. Workers' perceptions of how jobs affect health: a social ecological perspective. *Journal of occupational health psychology* 6 (2001), 101–113. Issue 2. https://doi.org/10.1037/1076-8998.6.2.101

[32] Marcus J. Fila. 2016. *Work Stress: A Review, Analysis, and Extension of the Job Demands-Control (-Support) Model*. Ph. D. Dissertation. Western Michigan University, Kalamazoo, MI. 1620.

[33] Arlene Fink. 2017. *How To Conduct Surveys* (6 ed.). SAGE Publications, Los Angeles.

[34] Center for Disease Control and Prevention. 2022. About Mental Health. https://www.cdc.gov/mentalhealth/learn/index.htm

[35] Denae Ford, Margaret-Anne Storey, Thomas Zimmermann, Christian Bird, Sonia Jaffe, Chandra Maddila, Jenna L Butler, Brian Houck, and Nachiappan Nagappan. 2021. A Tale of Two Cities: Software Developers Working from Home during the COVID-19 Pandemic. *ACM Trans. Softw. Eng. Methodol* 31 (2021). Issue 2. https://doi.org/10.1145/3487567

[36] Nicole Forsgren, Margaret-Anne Storey, Chandra Maddila, Thomas Zimmermann, Brian Houck, and Jenna Butler. 2021. The SPACE of Developer Productivity. *ACM Queue* 19 (3 2021). Issue 1.

[37] Michelle Fox. 2022. Employers boost mental wellness benefits amid the Great Resignation. https://www.cnbc.com/2022/05/05/employers-boost-mental-wellness-benefits-amid-the-great-resignation.html

[38] Silvana Galderisi, Andreas Heinz, Marianne Kastrup, Julian Beezhold, and Norman Sartorius. 2015. Toward a new definition of mental health. *World Psychiatry* 14 (2015), 231–233. Issue 2. https://doi.org/10.1002/wps.20231

[39] Garmin. 2022. What Is the Stress Level Feature on My Garmin Device? https://support.garmin.com

[40] Pavlína Wurzel Gonçalves and Alberto Bacchelli. 2022. Interpersonal Conflicts During Code Review Developers' Experience and Practices. *Proceedings of the ACM on Human-Computer Interaction* 6 (2022). https://doi.org/10.5281/zenodo.5848794

[41] Daniel Graziotin and Fabian Fagerholm. 2019. *Happiness and the Productivity of Software Engineers*. Apress, Berkeley, CA, 109–124. https://doi.org/10.1007/978-1-4842-4221-6_10

[42] Daniel Graziotin, Fabian Fagerholm, Xiaofeng Wang, and Pekka Abrahamsson. 2018. What happens when software developers are (un)happy. *Journal of Systems and Software* 140 (6 2018), 32–47. https://doi.org/10.1016/j.jss.2018.02.041

[43] Daniel Graziotin, Xiaofeng Wang, and Pekka Abrahamsson. 2013. Are Happy Developers more Productive? The Correlation of Affective States of Software Developers and their self-assessed Productivity. In *Proceedings of the 14th International Conference on Product-Focused Software Process Improvement (PROFES 2013)*, J. Heidrich, M. Oivo, and M.T. Jedlitschka A.Baldassarre (Eds.). Springer, Berlin, 50–64.

[44] Kelly Greenwood and Julia Anas. 2021. It's a New Era for Mental Health at Work. https://hbr.org/2021/10/its-a-new-era-for-mental-health-at-work

[45] Michaela Greiler, Margaret-Anne Storey, and Abi Noda. 2021. An Actionable Framework for Understanding and Improving Developer Experience. *JOURNAL OF TRANSACTION ON SOFTWARE ENGINEERING* (2021). https://github.com/get-dx/

[46] Christiane Grunloh, Miriam Cabrita, Carina Dantas, and Sofia Ortet. 2022. Opportunities, ethical challenges, and value implications of pervasive sensing technology for supporting older adults in the work environment. *Australasian Journal of Information Systems* (2022). https://doi.org/10.3127/ajis.v26i0.3133

[47] Joseph G. Grzywacz, David M. Almeida, and Daniel A. McDonald. 2002. Work-Family Spillover and Daily Reports of Work and Family Stress in the Adult Labor Force. *Family Relations* 51 (1 2002), 28–36. Issue 1. https://doi.org/10.1111/j.1741-3729.2002.00028.x

[48] Donald W. De Guerre, Merrelyn Emery, Peter Aughton, and Andrew S. Trull. 2008. Structure underlies other organizational determinants of mental health: Recent results confirm early sociotechnical systems research. *Systemic Practice and Action Research* 21 (10 2008), 359–379. Issue 5. https://doi.org/10.1007/s11213-008-9101-0

[49] Jan Alexander Hausser, Andreas Mojzisch, Miriam Niesel, and Stefan SchulzHardt. 2010. Ten years on: A review of recent research on the Job Demand–Control (-Support) model and psychological well-being. *Work and Stress* (2010). https://doi.org/10.1080/02678371003683747

[50] Headspace. 2022. Headspace. https://www.headspace.com/

[51] World Health Organization Mental Health and Substance Use. 2022. *World mental health report: Transforming mental health for all - executive summary*. Technical Report.

[52] Clara E. Hill, Barbara J. Thompson, and Elizabeth Nutt Williams. 1997. A Guide to Conducting Consensual Qualitative Research. *The Counseling Psychologist* 25 (10 1997), 517–572. Issue 4. https://doi.org/10.1177/0011000097254001

[53] Esther Howe, Jina Suh, Mehrab Bin Morshed, Daniel McDuff, Kael Rowan, Javier Hernandez, Marah Ihab Abdin, Gonzalo Ramos, Tracy Tran, and Mary P Czerwinski. 2022. Design of Digital Workplace Stress-Reduction Intervention Systems: Effects of Intervention Type and Timing. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery (ACM), New York, NY, USA, 1–16. https://doi.org/10.1145/3491102.3502027

[54] Chioma Iwunze. 2021. Remote Software Developers and Mental Health. https://www.gitkraken.com/blog/remote-software-developers

[55] Eunkyung Jo, Austin L. Toombs, Colin M. Gray, and Hwajung Hong. 2020. Understanding Parenting Stress through Co-designed Self-Trackers. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 1–13. https://doi.org/10.1145/3313831.3376359

[56] Brittany Johnson, Thomas Zimmermann, and Christian Bird. 2019. The Effect of Work Environments on Productivity and Satisfaction of Software Engineers. *IEEE Transactions on Software Engineering* 47 (2019), 736–757. Issue 4. https://doi.org/10.1109/TSE.2019.2903053

[57] Eirini Kalliamvakou. 2021. Octoverse Spotlight 2021: The Good Day Project—Personal analytics to make your work days better. https://github.blog/2021-05-25-octoverse-spotlight-good-day-project/

[58] Jodi Kantor and Arya Sundaram. 2022. The Rise of the Worker Productivity Score. https://www.nytimes.com/interactive/2022/08/14/business/worker-productivity-tracking.html

[59] Dennis L. Kappen and Rita Orji. 2017. Gamified and Persuasive Systems as Behavior Change Agents for Health and Wellness. *XRDS* 24, 1 (sep 2017), 52–55. https://doi.org/10.1145/3123750

[60] Robert Karasek and Tores Theorell. 1990. *Healthy work : stress, productivity, and the reconstruction of working life*. New York: Basic Books, New York, NY, USA.

[61] Simon Karlsson, Ottilia Olsson, and Maria Normark. 2022. "I feel like I've never really achieved it": A critical analysis of persuasive design patterns in mindfulness applications. In *Nordic Human-Computer Interaction Conference (NordiCHI '22)*. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/3546155.3546678

[62] Harmanpreet Kaur, Alex C Williams, Daniel McDuff, Mary Czerwinski, Jaime Teevan, and Shamsi T Iqbal. 2020. Optimizing for Happiness and Productivity: Modeling Opportune Moments for Transitions and Breaks at Work. *CHI'20* (2020). https://doi.org/10.1145/3313831.3376817

[63] Christina Kelley, Bongshin Lee, and Lauren Wilcox. 2017. Self-tracking for mental wellness: Understanding expert perspectives and student experiences. In *Conference on Human Factors in Computing Systems - Proceedings*, Vol. 2017-May. Association for Computing Machinery, New York, NY, USA, 629–641. https://doi.org/10.1145/3025453.3025750

[64] Corey L M Keyes. 2002. The mental health continuum: from languishing to flourishing in life. *Journal of health and social behavior* 43 (6 2002), 207–22. Issue 2.

[65] Corey L M Keyes. 2002. *Selecting Outcomes for the Sociology of Mental Health: Issues of Measurement and Dimensionality*. Technical Report. 207–222 pages. Issue 2.

[66] Gail Kinman and Fiona Jones. 2005. Lay representations of workplace stress: What do people really mean when they say they are stressed? *Work and Stress* 19 (4 2005), 101–120. Issue 2. https://doi.org/10.1080/02678370500144831

[67] Rachel Kornfield, Jonah Meyerhoff, Hannah Studd, Ananya Bhattacharjee, Joseph J Williams, Madhu Reddy, and David C Mohr. 2022. Meeting Users Where They Are: User-centered Design of an Automated Text Messaging Tool to Support the Mental Health of Young Adults. In *Proc SIGCHI Conf Hum Factor Comput Syst*. ACM, New York, NY, USA. https://doi.org/10.1145/3491102.3502046

[68] Miikka Kuutila, Mika V. Mäntylä, Maëlick Claes, and Marko Elovainio. 2018. Daily questionnaire to assess self-reported well-being during a software development project. In *Proceedings - International Conference on Software Engineering*. IEEE Computer Society, New York, NY, USA, 39–43. https://doi.org/10.1145/3194932.3194942

[69] Christine Lagorio-Chafkin. 2022. Bumble Gave Nearly Its Entire Staff a Week Off to Combat Burnout. Here's What It Learned. https://www.inc.com/christine-lagorio-chafkin/bumble-whitney-wolfe-herd-employee-wellness-time-off-burnout.html

[70] Juwon Lee, Megan Lam, and Caleb Chiu. 2019. *Clara: Design of a New System for Passive Sensing of Depression, Stress and Anxiety in the Workplace*. Springer, Cham, 12–28. https://doi.org/10.1007/978-3-030-25872-6_2

[71] Megan Leonhardt. 2022. 66% of companies are making changes to better support mental well-being. https://fortune.com/well/2022/06/01/companies-making-changes-to-support-mental-wellbeing/

[72] Debra Lerner and Rachel Mosher Henke. 2008. What does research tell us about depression, job performance, and work productivity? *Journal of Occupational and Environmental Medicine* 50 (2008), 401–410. Issue 4. https://doi.org/10.1097/

JOM.0b013e31816bae50
[73] Alain Marchand, Pierre Durand, Victor Haines, and Steve Harvey. 2015. The multilevel determinants of workers' mental health: results from the SALVEO study. *Social Psychiatry and Psychiatric Epidemiology* 50 (3 2015), 445–459. Issue 3. https://doi.org/10.1007/s00127-014-0932-y
[74] Gloria Mark, Daniela Gudith, and Ulrich Klocke. 2008. The cost of interrupted work. In *Proceeding of the twenty-sixth annual CHI conference on Human factors in computing systems - CHI '08*. ACM Press, New York, New York, USA, 107. https://doi.org/10.1145/1357054.1357072
[75] Gloria Mark, Shamsi Iqbal, and Mary Czerwinski. 2018. How blocking distractions affects workplace focus and productivity. In *CHI '18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3123024.3124558
[76] Eira May. 2022. The Great Resignation is here. What does that mean for developers? https://stackoverflow.blog/2022/01/10/the-great-resignation-is-here-what-does-that-mean-for-developers/
[77] André N Meyer, Earl T Barr, Christian Bird, and Thomas Zimmermann. 2021. Today Was a Good Day: The Daily Life of Software Developers. *IEEE Transactions on Software Engineering* 47 (2021). Issue 5. https://doi.org/10.1109/TSE.2019.2904957
[78] André N Meyer, Laura E Barton, G. Murphy, T. Zimmermann, and Thomas Fritz. 2017. The Work Life of Developers: Activities, Switches and Perceived Productivity. *IEEE Transactions on Software Engineering* (2017). https://doi.org/10.1109/TSE.2017.2656886
[79] Microsoft. 2022. Viva Insights Home. https://docs.microsoft.com/en-us/viva/insights/personal/teams/viva-insights-home
[80] Lorna Mitchell. 2021. 5 ways to improve mental health for software developers TechCrunch. https://techcrunch.com/2021/11/11/5-ways-to-improve-mental-health-for-software-developers/
[81] Mehrab Bin Morshed, Samruddhi Shreeram Kulkarni, Koustuv Saha, Richard Li, Leah G. Roper, Lama Nachman, Hong Lu, Lucia Mirabella, Sanjeev Srivastava, Kaya de Barbaro, Munmun De Choudhury, Thomas Plötz, and Gregory Abowd. 2022. Food, Mood, Context: Examining College Students' Eating Context and Mental Well-Being. *ACM Transactions on Computing for Healthcare* (6 2022). https://doi.org/10.1145/3533390
[82] Elizabeth L. Murnane, Tara G. Walker, Beck Tench, Stephen Voida, and Jaime Snyder. 2018. Personal informatics in interpersonal contexts: Towards the design of technology that supports the social ecologies of long-term mental health management. *Proceedings of the ACM on Human-Computer Interaction* 2 (11 2018). Issue CSCW. https://doi.org/10.1145/3274396
[83] E. C. W. Ng and A. T. Fisher. 2013. Understanding Well-Being in Multi-Levels: A review. *Health, Culture and Society* 5 (11 2013), 308–323. Issue 1. https://doi.org/10.5195/hcs.2013.142
[84] Oracle. 2021. *11 Ways to Prevent Employee Burnout.* Technical Report. https://www.oracle.com/a/ocom/docs/11-ways-to-prevent-employee-burnout.pdf
[85] Stack Overflow. 2020. Stack Overflow Developer Survey 2020. https://insights.stackoverflow.com/survey/2020/?utm_source=social-share&utm_medium=social&utm_campaign=dev-survey-2020#overview
[86] Stack Overflow. 2021. Stack Overflow Developer Survey 2021. https://stackoverflow.blog/2021/12/07/new-data-what-developers-look-for-in-future-job-opportunities/
[87] Annick Parent-Lamarche and Alain Marchand. 2019. Well-being at work from a multilevel perspective: what is the role of personality traits? *International Journal of Workplace Health Management* 12 (10 2019), 298–317. Issue 5. https://doi.org/10.1108/IJWHM-05-2019-0066
[88] Mind Share Partners. 2021. *2021 Mental Health at Work Report.* Technical Report.
[89] Adam C Powell, Matthias B Bowman, and Henry T Harbin. 2019. Reimbursement of Apps for Mental Health: Findings From Interviews. In *JMIR Ment Health*, Vol. 6. https://doi.org/10.2196/14724
[90] Meta Quest. 2021. Introducing Horizon Workrooms: Remote Collaboration Reimagined. https://about.fb.com/news/2021/08/introducing-horizon-workrooms-remote-collaboration-reimagined/
[91] Rajeev Raizada. 2021. Clinical depression as the sports injury of academia. https://rajraizada.medium.com/clinical-depression-as-the-sports-injury-of-academia-ad1267c396e3
[92] Antonia Rich, Amira Aly, Marta E. Cecchinato, Laura Lascau, Magdalen Baker, Rowena Viney, and Anna L. Cox. 2020. Evaluation of a novel intervention to reduce burnout in doctors-in-training using self-care and digital wellbeing strategies: a mixed-methods pilot. *BMC Medical Education* 20 (12 2020), 294. Issue 1. https://doi.org/10.1186/s12909-020-02160-y
[93] Ramon Rico, Cristina Gibson, Miriam Sanchez-Manzanares, and Mark A. Clark. 2020. Team adaptation and the changing nature of work: Lessons from practice, evidence from research, and challenges for the road ahead. *Australian Journal of Management* 45 (8 2020), 507–526. Issue 3. https://doi.org/10.1177/0312896220918908
[94] Carol D. Ryff. 1995. Psychological Well-Being in Adult Life. *Current Directions in Psychological Science* 4 (8 1995), 99–104. Issue 4. https://doi.org/10.1111/1467-8721.ep10772395
[95] Koustuv Saha, Ayse E. Bayraktaroglu, Andrew T. Campbell, Nitesh V. Chawla, Munmun De Choudhury, Sidney K. D'Mello, Anind K. Dey, Ge Gao, Julie M. Gregg, Krithika Jagannath, Gloria Mark, Gonzalo J. Martinez, Stephen M. Mattingly, Edward Moskal, Anusha Sirigiri, Aaron Striegel, and Dong Whi Yoo. 2019. Social Media as a Passive Sensor in Longitudinal Studies of Human Behavior and Wellbeing. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 1–8. https://doi.org/10.1145/3290607.3299065
[96] Koustuv Saha, Sang Chan Kim, Manikanta D. Reddy, Albert J. Carter, Eva Sharma, Oliver L. Haimson, and Munmun De Choudhury. 2019. The Language of LGBTQ+ Minority Stress Experiences on Social Media. *Proceedings of the ACM on Human-Computer Interaction* 3 (11 2019), 1–22. Issue CSCW. https://doi.org/10.1145/3361108
[97] Johnny Saldana. 2021. *The Coding Manual For Qualitative Researchers* (4 ed.). SAGE Publications, London.
[98] Samsung. 2022. Measure your stress level with Samsung health. https://www.samsung.com/us/support/answer/ANS00080574/
[99] Pedro Sanches, Axel Janson, Pavel Karpashevich, Camille Nadal, Chengcheng Qu, Claudia Daudén Roquet, Muhammad Umair, Charles Windlin, Gavin Doherty, Kristina Höök, and Corina Sas. 2019. HCI and Affective Health Taking stock of a decade of studies and charting future research directions. In *Conference on Human Factors in Computing Systems - Proceedings*. Association for Computing Machinery, New York, New York, USA. https://doi.org/10.1145/3290605.3300475
[100] Corina Sas, Kristina Höök, Gavin Doherty, Pedro Sanches, Tim Leufkens, and Joyce Westerink. 2020. Mental wellbeing: Future agenda drawing from design, HCI and big data. In *DIS 2020 Companion - Companion Publication of the 2020 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, Inc, New York, New York, USA, 425–428. https://doi.org/10.1145/3393914.3395920
[101] Janice Singer, Timothy Lethbridge, Norman Vinson, and Nicolas Anquetil. 1997. An Examination of Software Engineering Work Practices. *1997 conference of the Centre for Advanced Studies on Collaborative research (CASCON '97)* (1997).
[102] Darja Smite, Nils Brede Moe, Eriks Klotins, and Javier Gonzalez-Huerta. 2022. From forced Working-From-Home to voluntary working-from-anywhere: Two revolutions in telework. *Journal of Systems and Software* 195 (2022). https://doi.org/10.1109/TSE.2017.2656886
[103] Darja Smite, Anastasiia Tkalich, Nils Brede Moe, Efi Papatheocharous, Eriks Klotins, and Marte Pettersen Buvik. 2022. Changes in perceived productivity of software engineers during COVID-19 pandemic: The voice of evidence. *Journal of Systems and Software* 186 (2022), 111197. https://doi.org/10.1016/j.jss.2021.111197
[104] Andrew Smith. 2022. A Holistic Approach to the Well-being of Nurses: A combined Effects Approach. *Advances in Social Sciences Research Journal* 9 (1 2022), 475–484. Issue 1. https://doi.org/10.14738/assrj.91.11650
[105] Mauricio Soto, Chris Satterfield, Thomas Fritz, Gail C. Murphy, David C. Shepherd, and Nicholas Kraft. 2021. Observing and predicting knowledge worker stress, focus and awakeness in the wild. *International Journal of Human Computer Studies* 146 (2 2021). https://doi.org/10.1016/j.ijhcs.2020.102560
[106] Garen Staglin. 2021. Prevent employee burnout..or face the great resignation. *Forbes* (10 2021). https://www.forbes.com/sites/onemind/2021/10/27/prevent-employee-burnout--or-face-the-great-resignation/?sh=34cb1d33cb5b
[107] Standuply. 2022. Standuply. https://standuply.com/
[108] Walter F Stewart, Judith A Ricci, Elsbeth Chee, Steven R Hahn, and David Morganstein. 2003. *Cost of Lost Productive Work Time Among US Workers With Depression.* Technical Report. https://jamanetwork.com/
[109] Zara Stone. 2022. A mental-health crisis is brewing in Silicon Valley as tech workers complain of sexual issues, burnout, and distress. Some say even the perks can't make them stay. *Business Insider* (4 2022).
[110] Franziska Tachtler, Reem Talhouk, and Toni Michel. 2021. Unaccompanied migrant youth and mental health technologies: A social-ecological approach to understanding and designing. In *Conference on Human Factors in Computing Systems - Proceedings*. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/3411764.3445470
[111] TeamRetro. 2022. TeamRetro. https://www.teamretro.com/
[112] Anja Thieme, Madeline Balaam, Jayne Wallace, David Coyle, and Siân Lindley. 2012. Designing wellbeing. In *Proceedings of the Designing Interactive Systems Conference on - DIS '12*. ACM Press, New York, New York, USA, 789. https://doi.org/10.1145/2317956.2318075
[113] Anja Thieme, Jayne Wallace, Paula Johnson, John McCarthy, Siân Lindley, Peter Wright, Patrick Olivier, and Thomas D. Meyer. 2013. Design to promote mindfulness practice and sense of self for vulnerable women in secure hospital services. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 2647–2656. https://doi.org/10.1145/2470654.2481366

[114] Anja Thieme, Jayne Wallace, Thomas D. Meyer, and Patrick Olivier. 2015. Designing for mental wellbeing: Towards a more holistic approach in the treatment and prevention of mental illness. In *ACM International Conference Proceeding Series*. Association for Computing Machinery, New York, NY, USA, 1–10. https://doi.org/10.1145/2783446.2783586

[115] Kristy Threlkeld. 2021. *Employee Burnout Report: COVID-19's Impact and 3 Strategies to Curb It.* Technical Report. https://www.indeed.com/lead/preventing-employee-burnout-report

[116] Valerie Tiberius. 2020. *Well-being, philosophical theories of.* Springer Netherlands, Dordrecht, 1–4.

[117] Gul Tokdemir. 2022. Software professionals during the COVID-19 pandemic in Turkey: Factors affecting their mental well-being and work engagement in the home-based work setting. *Journal of Systems and Software* 188 (6 2022). https://doi.org/10.1016/j.jss.2022.111286

[118] Bianca Trinkenreich, Ricardo Britto, Marco Aurelio Gerosa, and Igor Steinmacher. 2022. An Empirical Investigation on the Challenges Faced by Women in the Software Industry: A Case Study. In *Proceedings of the 2022 ACM/IEEE 44th International Conference on Software Engineering: Software Engineering in Society*. Association for Computing Machinery, New York, NY, USA, 24–35. https://doi.org/10.1145/3510458.3513018

[119] National Research Council (US) and Institute of Medicine (US). 2009. *Preventing Mental, Emotional, and Behavioral Disorders Among Young People.* National Academies Press, Washington, D.C. https://doi.org/10.17226/12480

[120] Sarah B. Watson, Yong Wah Goh, and Sukanlaya Sawang. 2011. Gender Influences on the Work-Related Stress-Coping Process. *Journal of Individual Differences* 32 (2011), 39–46. Issue 1. https://doi.org/10.1027/1614-0001/a000033

[121] Eoin Whelan, Daniel Mcduff, Rob Gleasure, and Jan Vom Brocke. 2018. *How Emotion-Sensing Technology Can Reshape the Workplace.* Technical Report. MIT Sloan Management Review. 7–10 pages. http://mitsmr.com/2nJUBPC

[122] Alex C. Williams, Harmanpreet Kaur, Gloria Mark, Anne Loomis Thompson, Shamsi T. Iqbal, and Jaime Teevan. 2018. Supporting workplace detachment and reattachment with conversational intelligence. In *Conference on Human Factors in Computing Systems - Proceedings*, Vol. 2018-April. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/3173574.3173662

[123] Jong Min Woo, Won Kim, Tae Yeon Hwang, Kevin D. Frick, Byong Hwi Choi, Yong Jin Seo, Eun Ho Kang, Se Joo Kim, Byong Joo Ham, Jun Seok Lee, and Yu Lee Park. 2011. Impact of depression on work productivity and its improvement after outpatient treatment with antidepressants. *Value in Health* 14 (2011), 475–482. Issue 4. https://doi.org/10.1016/j.jval.2010.11.006

[124] One Mind At Work. 2020. *MENTAL HEALTH IN THE WORKPLACE 2020: CHRO Insights Series OCTOBER 2020.* Technical Report.

[125] Hossein Abad Zahra Shakeri, Oliver Karras, Kurt Schneider, Ken Barker, and Mike Bauer. 2018. Task Interruption in Software Development Projects. In *Proceedings of the 22nd International Conference on Evaluation and Assessment in Software Engineering 2018*. ACM, New York, NY, USA, 122–132. https://doi.org/10.1145/3210459.3210471

[126] Åsa Cajander, Marta Larusdottir, Elina Eriksson, and Gerolf Nauwerck. 2015. Contextual Personas as a Method for Understanding Digital Work Environments. In *Human Work Interaction Design. Work Analysis and Interaction Design Methods for Pervasive and Smart Workplaces. HWID 2015. IFIP Advances in Information and Communication Technology*, Vol. 468. Springer, Cham. https://doi.org/10.1007/978-3-319-27048-7_10