

Interpersonal Collaboration to Support Digitally Mediated Gig Workers' Well-being in Pre- and Post-Pandemic Times

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The COVID-19 outbreak has raised concerns about its impact on gig workers, who perform on-demand flexible work that is mediated by digital work platforms (e.g., Uber and DoorDash), in terms of their safety, health, and well-being. The situation facing gig workers is also closely related to the public as the demand for the services provided by them has increased dramatically. However, the need for better supporting gig workers' well-being and work-life balance is not new. Issues such as lack of self-awareness about personal health conditions or uncontrolled long working hours tend to be common among workers. Given the flexibility of gig work, it remains unclear what mechanisms or interventions may improve the well-being awareness and practices of workers. In this short paper, we discuss the potential may serve to fostering health collaboration between the workers and their significant others (e.g., family members) through technological medications. We present a pre-pandemic case study that deploys a social sensing mobile app to Uber and taxi drivers and their partners for a month. The app allows a partner to access a worker's health sensing data, add interpersonal observations about the worker's wellness, and participate in the process of their well-being management. We reflect on what we learned from this pre-pandemic study in order to shed light on ways to support well-being management for gig workers in the current and post-pandemic times.

Additional Key Words and Phrases: Gig workers; Work-life balance; Well-being; Health sensing; Collaborative health management; Computer-supported collaboration; Sharing economy

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1 INTRODUCTION

As work becomes increasingly digitized (e.g., relying on algorithmic mediation for distributed job assignments and work communication), gig work, i.e., short-term, flexible employment enabled by data- and algorithm-driven digital platforms has become increasingly popular as both a part-time and full-time job option given its flexibility and low barrier of entry. Recent estimates of the size of

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the gig or platform economy in the United States suggest that similar non-traditional freelancing-based work already involves over 50 million workers, which accounts for more than 30% of the entire workforce [11, 15]. Despite the popularity of gig work, some potential issues concerning the physical, subjective, and social wellness of gig workers, such as fatigue and emotional labor, have been initially identified [5].

Throughout the COVID-19 pandemic, the adequacy of protection and system support for gig workers' well-being have started to surface as an important concern [13]. Since gig workers, such as ridesharing drivers or delivery personnel, are conventionally viewed as independent contractors, they are at times not entitled to typical workers' welfare (e.g., sick pay or health insurance) [3]. Consequently, it could be that gig workers are currently one of the most vulnerable and high-risk groups at the current time. Making things worse, at the onset of the shelter-in-place orders and self-quarantines, the demand for delivery workers for companies like Instacart and UberEats may have increased due to the increased need for delivery services in many communities [10]. Digital work platforms may also be incentivizing workers to drive or deliver without sufficient support (e.g., personal protective equipment, disinfectant or sick pay to high-risk workers) [8, 10]. The likely high demand for specific types of gig workers in the current climate and the vulnerability of this work population can create tension between workers, platform providers, and the general public, which raises the need to systematically reconsider how to support the well-being of gig workers.

To achieve the balance between work and well-being, workers first will need to be able to see the relationship between personal well-being and work-related decisions. Proper management of this relationship entails being able to control work and sleep hours, exercise, and take further measures intended to mitigate risks to health amid the pandemic. Through the use of existing health sensing technologies such as wearable health trackers e.g., Apple Watch and Fitbit, there is a possibility of supporting workers' awareness and decision making around the balance of work and well-being using digitally tracked activity data and records. However, information pertaining to personal well-being could be potentially overlooked or disregarded by regular users [12], and therefore by gig workers as well for numerous reasons. These include a lack of interest in changing old practices, barriers to understanding health tracking data, or simply failing to calculate how much work they can still afford to do given the reinforcing incentives mediated by the work platforms that drive them to work more. In post-pandemic times, it is possible that external incentives and personal financial needs may increase the demand for gig work [10], and disrupt work-wellbeing and work-life balance of the workers even more than now.

In summary, promoting well-being in gig work, especially in the ongoing and post-pandemic times, will require studies to elucidate the means by which workers assess their health and well-being, including the mechanisms that motivate individuals to formulate pro-health work decisions and practices.

1.1 Collaborative Health Sense-making for Individual and Collective Well-being

For health tracking with sensing technologies to be useful, it is essential to understand how individuals make sense of this sensing data when facing real health issues [9]. Prior work on personal health sense-making conceptualized health management from an individual-centered perspective where individuals strive to improve their comprehension and interpretation of the tracking data without necessarily working with other people [16]

However, there are at least two major challenges to sense-making with technological tracking. First, such data can be technically limited in its accuracy and scope. A tendency towards false positives or false negatives can result from noisy sensing, potentially obscuring non-experts' sense-making. Also, sensing data like walking distance or number of steps taken can be deemed irrelevant

from a worker's perspective (e.g., limited time to walk as perceived by some gig drivers). Second, interpreting the data could itself be difficult even when it is accurate, as individuals may lack the motivation or cognitive resources (e.g., attention, training, experience, knowledge) to interpret it, or their interpretation could be constrained or erroneous.

Additionally, most people do not have access to a health professional who can assist them with data interpretation on a regular basis, and are probably not so eager to visit one, if no immediate health issue are present. Given the limitations of technological sensing, it is necessary to characterize well-being using other sources of information, such as self-reports provided by the individuals [17, 19]. Another mechanism to remedy these challenges is to introduce a social aspect into the sense-making process. Family members, being one of the key stakeholders of a person's health status, not only are motivated and appropriate to participate in the health sense-making process to support working individuals, but can become pivotal to the promotion of collective well-being in a broader social network that goes beyond just individual workers with the diverse social roles and social capitals introduced this way.

Studies in HCI and health informatics have begun to note the potential values of including observations and interpretations from people socially connected to individuals, e.g., people who live closely or communicate frequently with the individuals [7], co-workers who interact with them at work [14], or remote friends and others who talk through computer-mediated communicative networks [18]. Prior studies have also shown the viability of using social media to provide and receive support on health-related practices, such as posting food journaling pictures on Instagram to track eating behaviors [4]. What is missing is an understanding of how this sort of collaborative health sensing might affect gig workers and their work practices, especially in the potentially changing landscape of post-pandemic work.

In the rest of this short paper, we will concisely present a pre-pandemic study, which deploys a social sensing mobile app to Uber and taxi drivers for a month in Taipei, Taiwan, allowing the workers and their intimate partners to share health sensing data captured by the workers' health trackers (e.g., Fitbit), and to collaboratively interpret and use the information for decision making and behavioral change. We then reflect on what we learn from this pre-pandemic study and discuss the implications it has on work-wellbeing balance for gig work in post-pandemic time.

2 CASE STUDY: SUPPORTING WORKING DRIVERS WITH PARTNERS' SHARED USE OF HEALTH SENSING DATA

To explore the problem and design space associated with collaborative health support and socially shared technological sensing data, we have focused on understanding and supporting a specific group of workers; professional drivers, who are experiencing long working hours (e.g., taxi and Uber drivers working more than 10 hours a day). Through prototyping and a field study, we aim to understand health practices behind their everyday work and to identify potential well-being support solutions through socially shared use of health sensing data. The study was conducted in the summer of 2019, prior to the COVID-19 outbreak.

2.1 Mediating Health Collaboration through a Social Sensing App

To understand how workers and/or their partners perceive the workers' health and well-being status and its impact on work performance and safety in the context of driving as an occupation, we prototyped a social sensing and probing technology for drivers.

The social sensing prototype has three main functions: (1) collecting personal sensing data from a driver's tracker; (2) incorporating self (or interpersonal) reports from drivers (or partners); (3) visualizing data (e.g., personal sensing data, self-assessments, and interpersonal observations) shared between drivers and partners to enable social sensing. Taken together, the prototype provides

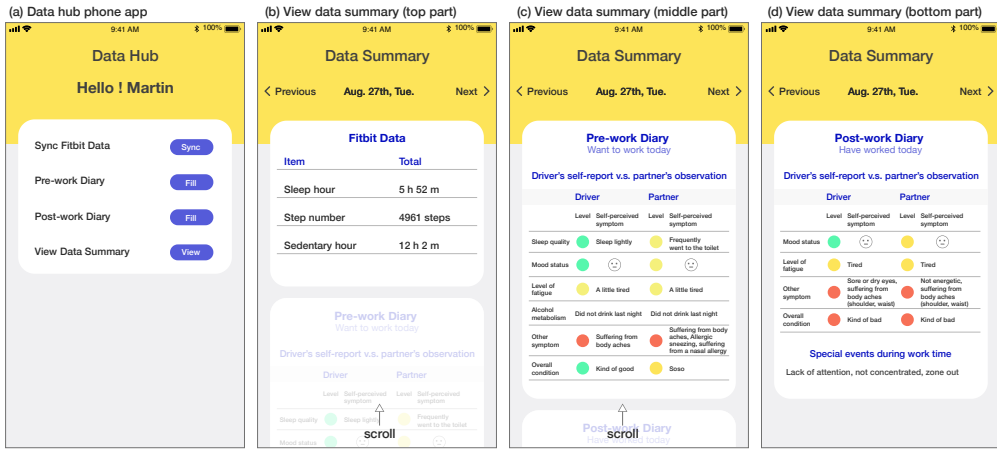


Fig. 1. (a) The main page of Data Hub app and (b ~ d) the Data Summary webpage. User can scroll to view the three tables at the top (Fitbit data), the middle (pre-work diary data) and the bottom (post-work diary) of the webpage.

rich and easily comprehensible data to help drivers make informed decisions about scheduling work and taking breaks. Figure 1 shows the user interface of the probing system, which consists of a Fitbit wristband [1], a data hub app, and a visualization web page.

We use the pre- and post-work diary, which consist of probing questions (see Figure 1(a)), to obtain daily contextual feedback from drivers and their partners before and after work. The questions asked drivers to self-report (or partners to observe) their physical conditions (e.g., sleep quality, level of fatigue, and illness symptoms) and mental status (e.g., moods); it also asked drivers to detail why they chose to refine their working schedule or why they plan to. The questions also asked partners if they planned to and made any reminders or suggestions for drivers.

The Fitbit data table (Figure 1(b)) summarizes the sleep hours, step counts, and sedentary hours in three rows that are synchronized with the Fitbit wristband. The pre-work diary (Figure 1(c)) lists a summary of a driver's sleep quality the previous night, current mood status, current level of fatigue, current symptoms, and current overall condition perceived by the driver and/or observed by their partner before starting work. The post-work diary (Figure 1(d)) lists a summary of a driver's mood status, level of fatigue, symptoms, and overall condition perceived by the driver and/or observed by their partner after work.

2.2 Deployment

To deploy and study the prototype, we recruited professional drivers (taxi and Uber drivers) from Facebook and other online discussion groups, local taxi companies, and snowball sampling. We recruited 10 professional drivers (all males) aged from 26 to 57 years old. As they all work full time, they drive an average of 10.9 hours per day to achieve their expected daily income target. Eight participants were taxi drivers. These taxi drivers can either pick up passengers on the street or accept a ride request from a customer's apps. The remaining two participants were Uber drivers. They can only accept a ride request through the Uber app. All partners recruited (all females), aged from 27 to 56 years, are the significant others of the recruited drivers. Each dyad of driver and partner live together and have face-to-face interactions nearly every day, which allows the partner to observe the driver's conditions and provide reminders before and after work.

During the four-week study, drivers were asked to continuously wear Fitbit and use our prototype to sync the Fitbit data, which includes sleep hours, step counts, and sedentary hours, before and after work. In addition, their partners and they were asked to fill out the pre- and post-work diary every day. The integration of technology and social sensing data was visualized and converted to Data Summaries (see Figure 1) for drivers and partners to review. Two semi-structured interviews were administered in the middle and end of the study to understand the ongoing practices of well-being and health collaboration made possible through the use of the social sensing app.

2.3 Observations

2.3.1 Working Individuals' Limitations. Given their work- and income-driven schedule, drivers tended to underestimate their physical and health conditions as well as how these factors may influence their work performance. They were inclined to follow their predetermined appointments and drive around for more earning opportunities if time permitted. Our participants pointed out that prior to our study, they occasionally adjusted their work schedule when they suffered from sleep deficit or fatigue. For example, they may pull over after a ride to take a rest or take a longer time off between rides/appointments if they feel drained. However, it remains difficult for them to accurately assess their levels of fatigue. Due to financial pressure and a tendency to increase working hours, drivers mentioned that they may need extra help to steer clear of the potential negative impacts of long-hour working.

With a raised awareness of their own behaviors based on the Fitbit data and their diary keeping, our participants were prompted to modify their intentions toward how they engage in pro-health behaviors. Our participants pointed out that despite their intention of the apply modifications, contextual limitations such as concerns for earnings, passenger reservations, and their work schedule prevented them from overhauling their behaviors.

2.3.2 Health Collaboration through Social Sensing. As the closest social connection in a driver's network, their partner is expected to serve as a key part of the social sensing system in their health management process.

In this study, we have seen that partners use the Fitbit data to remind the workers of important things. According to the partners, before the social sensing app was introduced, they were unable to assess their partner's health by mere observation and thus unable to pinpoint what suggestions to offer. In addition to health data, partners also contributed their own observations; as well as their shared information about the drivers' daily schedule and other contextual information for suggestions.

To persuade the drivers to form an intention to change, some partners used the strategy of assigning them simple tasks to do between rides so that they could have some time off from their work. With technological mediation, the partner participants reviewed the data in the Summary page of the app and identified better time windows to remind the drivers of their health and well-being status and adjusting their work arrangement.

Moreover, partner participants have mentioned that with the technological sensing and the self-reported data, they were able to buttress their suggestions for the drivers to change their work schedule and other health-related aspects, and it seems more likely that drivers will comply as well, as the data-supported reminders appeared to be more persuasive than daily nagging.

2.3.3 Toward Collective Well-being. Before the study, our driver participants rarely communicated with their partners about their well-being explicitly. Without technological mediation, their partners could only ask the drivers directly to identify when they should provide reminders for them to adjust their work arrangements. However, the drivers tended to give vague answers about their health and well-being status. Due to a lack of effective communication, their partners could miss

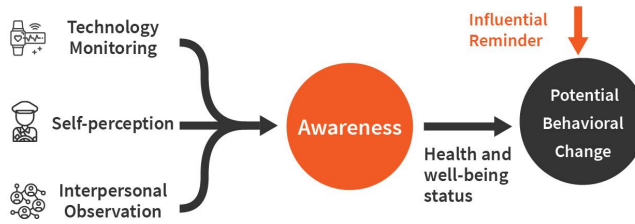


Fig. 2. How social sensing and interpersonal collaboration foster awareness and pro-wellbeing behaviors.

some mild symptoms of the drivers' health and well-being conditions. With the mediation of socially shared use of sensing data, we've seen signs of closer health collaboration between workers and their partners and a fostering of a sense of collectivity in pursuing work-wellbeing balance.

3 DISCUSSION

To characterize what we learned from this case study, Figure 2 depicts how system mechanisms like a social sensing app may foster health collaboration among workers and their significant others from the view of theories of behavioral change [2, 6]. On top of health sensing data captured by sensing technologies, adding shared interpersonal observations was found to make workers more aware of their well-being conditions, and to conquer some caveats common in gig work, such as failing to self-regulate their individual behaviors. Initial observations during the four-week study also suggest that there is a potential to trigger a worker's intention to change their behavior with technology-mediated interpersonal collaboration. The socially shared data available to workers and their partners appeared to increase the persuasiveness of the social reminders made by the partner and to ground the perspectives of both parties that could be originally different. The heightened health awareness, social persuasiveness and grounded perspectives elicited by the system are elements critical to the shaping of healthier and more sustainable gig work.

3.1 Collaborative Health Work in Post-Pandemic Gig Work

Although the case study presented was conducted during the relatively safe pre-COVID-19 period, we were already seeing numerous well-being challenges facing working drivers. During and after times of global pandemics, it is expected that many gig workers will take on roles to provide much of the "essential work" needed by the public (e.g., food and grocery delivery), which may add even more new challenges to the maintenance of their well-being, such as the need to take precautions to prevent infection and transmission of disease.

In the future, gig workers performing physical and essential work may contact far more people than other types of workers whose work can be transferred and performed online. By reflecting on what we learned from this pre-pandemic study, we believe that future gig work will need to shift from the mode of isolated, independent work to a new mode of collaborative health work in which the workers are coached and supported by family members or co-workers through data sharing and technological mediation.

While the designs of most work platforms in the past were optimized for efficiency, productivity, and flexibility, future designs may also need to incorporate the health and well-being dimensions for improving the sustainability and fairness of gig work. Platform-mediated health collaboration among co-workers and stakeholders (e.g., customers and workers) is another mechanism to explore in the future.

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