

Participatory Feasibility Assessment of an AI-Assisted Wearable for Psychosocial Risk Monitoring among Informal Bicycle Delivery Workers in Bogotá, Colombia

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Abstract

Background Informal bicycle delivery workers connected to digital platforms may be exposed to psychosocial conditions associated with variable working schedules, work demands, and the organization of platform-mediated work. Wearable technologies may provide opportunities to support the monitoring of physiological and behavioral indicators potentially relevant to psychosocial risk assessment. However, their feasibility and acceptability among informal platform workers remain insufficiently explored. **Objective** This study aimed to assess the feasibility, perceived usability, acceptance, and perceived usefulness of an AI-assisted wearable-based approach for psychosocial risk monitoring among informal bicycle delivery workers affiliated with digital platforms in Bogotá, Colombia. **Methods** A pilot participatory evaluation was conducted with six informal bicycle delivery workers who used a GIVURAO XF91616 IP67 wearable device for three months. The device provided information on step count, calories, heart rate, stress level, sleep quality, and heart-rate variability and incorporated a galvanic skin response sensor. An independent artificial intelligence agent trained in psychosocial risk was used to support the interpretation of curated information prepared by occupational safety and health professionals and organizational psychologists. The specific technical configuration, model architecture, and operational parameters of the AI-based interpretation system are intentionally not disclosed at this stage, as the system is currently undergoing internal validation and is under consideration for potential intellectual property protection and formal registration as a technological novelty. Participants evaluated comfort, ease of use, perceived usefulness, and acceptance/usability. A co-creation workshop was also conducted in which participants verbally assessed the conceptual and technical adequacy of the proposed control using a five-point agreement scale. Qualitative feedback was collected during the participatory process. **Results** Mean scores were 4.4/5 for comfort, 4.5/5 for ease of use, 4.5/5 for perceived usefulness, and 4.5/5 for overall acceptance and usability. During the three-month deployment, two device impacts caused minor damage, although the devices remained operational. In the participatory assessment, the statement that the control was fully adequate conceptually and technically received a mean score of 4.7/5, while adequacy in most aspects received 4.5/5. Participants perceived the technology as potentially useful for health, self-care, and occupational performance. They also identified the need to verify the quality of the data generated by the device and to consider individual work schedules, including night and early-morning work, when interpreting wearable-derived information. **Conclusions:** The pilot findings indicate favorable perceived usability, acceptance, usefulness, and conceptual and technical adequacy of the proposed wearable-based approach. The findings support further development and formal validation of AI-assisted wearable systems for psychosocial risk monitoring among informal platform workers. Details regarding the AI-based interpretation component are not disclosed in this manuscript due to ongoing validation processes and potential intellectual property considerations. Future research should include larger samples, individually recorded measurements, formal validation of physiological indicators, and contextual interpretation of data according to work schedules and circadian patterns.

Keywords

Psychosocial risk, Informal workers, Platform work, Bicycle delivery workers, Wearable technology, Artificial intelligence, Occupational safety and health, Participatory evaluation

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1. Introduction

The expansion of digital platforms has transformed the organization of work and contributed to the emergence of new forms of employment and income generation. Bicycle delivery workers represent a particularly relevant population within this transformation because their work combines physical mobility, digital platform management, variable schedules, exposure to environmental conditions, and continuous interaction with customers and platform systems. [1, 2, 3]

Although platform-mediated work may provide flexibility and opportunities for income generation, the organization of this work can also generate occupational challenges. [4, 2] Informal delivery workers may experience variable workloads, uncertain working schedules, pressure associated with delivery times and platform demands, and difficulties accessing conventional occupational safety and health mechanisms [5]. [6] These conditions make the identification and monitoring of psychosocial risk particularly relevant.

Psychosocial risk assessment traditionally relies on questionnaires, interviews, observations, and other instruments designed to identify organizational, occupational, and individual factors associated with workers' well-being. [7, 8] Although these approaches provide valuable information, they may present limitations when applied to highly dynamic work environments in which working conditions vary throughout the day and across workers.

Wearable technologies offer a complementary approach. Devices capable of recording physiological and behavioral indicators, including heart rate, heart-rate variability, sleep-related information, activity levels, and galvanic skin response, may provide additional information that can support the interpretation of workers' experiences and occupational conditions. However, physiological indicators cannot be interpreted independently of the social and organizational context in which they are generated. [9, 10, 11, 12]

Artificial intelligence may provide an additional layer for organizing and interpreting complex information. [13, 10, 14, 15, 16] In the present approach, AI was not conceived as a replacement for occupational safety and health professionals. Instead, an independent artificial intelligence agent trained in psychosocial risk was used to support the interpretation of information curated by professionals in occupational safety and health and organizational psychology. The technical details of this AI-based interpretation system are not disclosed in this manuscript, as the system is currently under internal validation and is being evaluated for potential intellectual property protection and formal registration as a novel technological development.

The combination of wearable monitoring, AI-assisted interpretation, and participatory evaluation may therefore provide a promising approach for informal workers whose occupational conditions are difficult to monitor using conventional approaches alone. Nevertheless, before such an approach can be considered for broader implementation, its feasibility, usability, acceptability, and perceived usefulness need to be explored among the target population. The present study therefore aimed to assess the feasibility, perceived usability, acceptance, and usefulness of an AI-assisted wearable-based approach for psychosocial risk monitoring among informal bicycle delivery workers connected to digital platforms in Bogotá, Colombia.

2. Methods

2.1. Study Design

A pilot exploratory study with a participatory evaluation approach was conducted in Bogotá, Colombia. The evaluation combined three complementary components: field use of a wearable device, participant assessment of usability and acceptance, and a participatory co-creation workshop.

The study was designed primarily to explore the feasibility and user experience associated with the proposed technological approach. It was not designed to establish the clinical validity of physiological indicators or to determine the effectiveness of the intervention in reducing psychosocial risk.

Indicator	Type	Potential relevance to psychosocial risk monitoring	Interpretation caveat
Step count	Behavioral/activity	Physical activity and workload context	Not a direct psychosocial risk measure
Calories	Activity/metabolic proxy	Physical workload context	Influenced by activity and individual characteristics
Heart rate	Physiological	Autonomic response/workload context	Influenced by physical activity and environmental conditions
Heart-rate variability	Physiological	Potential marker of autonomic regulation/stress response	Requires contextual and methodological validation
Stress level	Device-derived index	Potentially relevant to stress monitoring	Algorithm-dependent; requires validation
Sleep Quality	Behavioral/physiological	Relevant to recovery and work-schedule effects	Strongly influenced by schedule and individual factors
Galvanic skin response	Physiological	Potential indicator of sympathetic activation	Requires contextual interpretation

Table 1

Wearable-derived indicators considered in the pilot evaluation

2.2. Participants

Six informal bicycle delivery workers affiliated with digital platforms participated in the evaluation. The participants were young workers, and some were migrants. All participants performed bicycle-based delivery activities mediated through digital platforms.

The small sample was intentional in relation to the exploratory and participatory nature of the pilot. Consequently, the results are interpreted as preliminary evidence regarding feasibility and user perceptions rather than as statistically generalizable findings.

2.3. Wearable device and monitored indicators

Participants used a GIVURAO XF91616 IP67 wearable device for three months. The device provided information concerning:

- Step count;
- Calories;
- Heart rate;
- Stress level;
- Sleep quality; and
- Heart-rate variability (HRV).

The wearable also incorporated a galvanic skin response (GSR) sensor. The device was selected as part of the technological exploration of a wearable-based approach to psychosocial risk monitoring. The present study did not independently establish the diagnostic or psychometric validity of each physiological or behavioral indicator generated by the commercial device.

2.4. AI-Assisted psychosocial risk interpretation

The proposed technological approach incorporated an independent artificial intelligence agent trained in psychosocial risk. The AI component was designed to support the interpretation of information relevant to psychosocial risk rather than to replace professional assessment.

Information used by the AI agent was manually curated by personnel with expertise in occupational safety and health and organizational psychology. This expert-curation process was intended to provide contextual and domain-specific information for the AI-assisted interpretation.

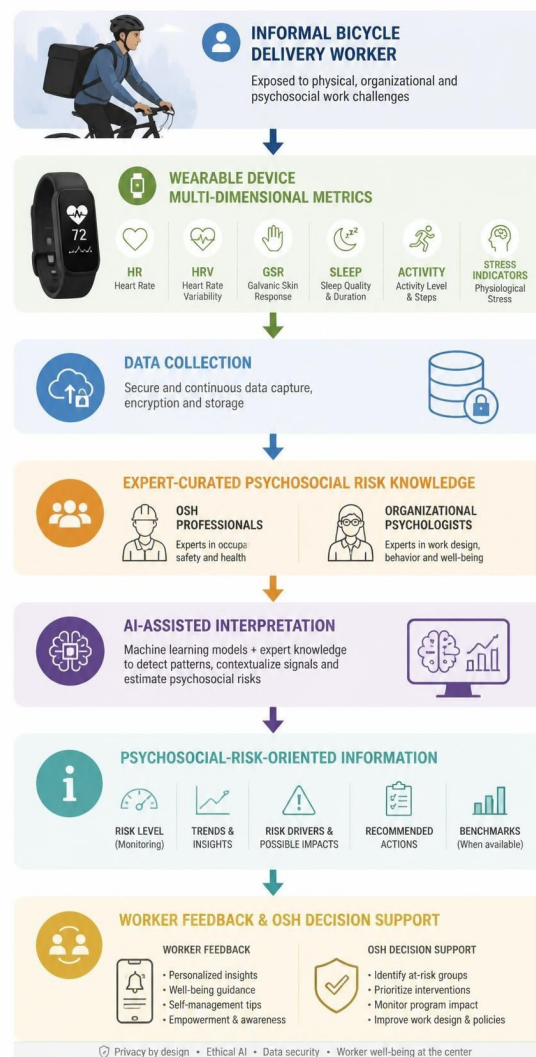


Figure 1: Conceptual architecture of the proposed AI-assisted wearable-based psychosocial risk monitoring approach.

The internal configuration, training strategy, and operational logic of the AI-based interpretation system are not disclosed in this manuscript, as the system is currently undergoing validation and is under evaluation for potential intellectual property protection and formal registration as a technological innovation.

Accordingly, the technological architecture explored in this pilot can be understood as an integrated process involving wearable data acquisition, expert-curated psychosocial risk information, and AI-assisted interpretation.

2.5. Field Deployment

The wearable devices were used by the participants over a three-month period. During this period, participants were able to use the devices under their usual working conditions. The field deployment allowed the research team to obtain information regarding practical use, perceived comfort, ease of use, usefulness, acceptance, and operational experiences. Particular attention was given to participants' perceptions of the device and to contextual factors that could affect the interpretation of wearable-derived information.

2.6. Participatory co-creation workshop

A co-creation workshop was conducted to obtain direct feedback from the participating workers. The activity sought to promote interaction between participants and the research process and to identify perceptions, needs, opportunities for improvement, and experiences associated with the proposed technological control. During the workshop, participants were asked to verbally assess the conceptual and technical adequacy of the proposed control.

A five-point agreement scale was used, with 1 corresponding to “disagree” and 5 corresponding to “agree.” Because the assessment was conducted orally, individual responses were not retained as a participant-level dataset. The research team recorded and consolidated the responses for each assessment statement.

2.7. Participatory rating procedure and data analysis

For each assessed component, a mean score was calculated using a simple arithmetic mean. The sum of the recorded ratings was divided by the number of valid responses. The resulting scores were interpreted descriptively as indicators of perceived adequacy. No inferential statistical analyses were conducted because of the exploratory nature of the study, the small sample size, and the absence of individually recorded responses for the oral assessment. Qualitative comments obtained during the workshop were reviewed thematically to identify recurrent perceptions and areas for improvement. Particular attention was given to comments concerning perceived usefulness, self-care, data quality, user interaction, and contextual characteristics of platform-based work.

2.8. Expert Assessment

The participatory findings were complemented by an interdisciplinary expert perspective involving professionals with backgrounds in occupational safety and health, organizational psychology, industrial design, business administration, and industrial engineering. The professionals involved had training and professional credentials related to occupational safety and health. The multidisciplinary perspective was used to support the interpretation of the technological proposal and its relationship with occupational risk management.

3. Results

3.1. Participants and field deployment

Six informal bicycle delivery workers affiliated with digital platforms participated in the pilot evaluation conducted in Bogotá, Colombia. The participants were young workers, and some were migrants. All participants were engaged in bicycle-based delivery activities mediated by digital platforms. The participants used a GIVURAO XF91616 IP67 wearable device for three months. The device provided information on step count, calories, heart rate, stress level, sleep quality, and heart-rate variability and incorporated a galvanic skin response sensor.

3.2. Perceived comfort, ease of use, usefulness, and acceptance

The three-month field experience showed favorable perceptions of the wearable-based approach. Participants rated comfort at 4.4/5, ease of use at 4.5/5, perceived usefulness at 4.5/5, and overall acceptance and usability at 4.5/5. The perceived usefulness score included participants’ assessment of additional device functionalities that were not directly related to the specific variables targeted by the study. No major difficulties associated with device use were reported.

Two incidents involving impacts to the wearable devices were reported during the deployment period. These incidents resulted in minor physical damage; however, the affected devices remained operational. These observations provide preliminary information regarding operational feasibility under the working



Figure 2: Study design and evaluation workflow.

Evaluation dimension	Mean score (/5)
Comfort	4.4
Ease of use	4.5
Perceived usefulness	4.5
Overall acceptance/usability	4.5

Table 2

Participants' perceived evaluation of the wearable-based approach. *Note: Scores were obtained from the participatory evaluation conducted after the field-use period. Values represent descriptive mean scores and should not be interpreted as psychometric validation measures.*

Assessment statement	Mean score (/5)
Fully adequate conceptually and technically	4.7
Adequate conceptually and technically in most aspects	4.5
Basically adequate conceptually and technically	3.5
Not adequate conceptually or technically	2.5

Table 3

Participatory assessment of the conceptual and technical adequacy of the proposed control.

conditions experienced by the participants, although they do not constitute a formal assessment of device durability.

3.3. Participatory assessment of conceptual and technical adequacy

During the co-creation workshop, the participants verbally assessed the conceptual and technical adequacy of the proposed control using a five-point agreement scale ranging from 1 ("disagree") to 5 ("agree"). The statement "The control is fully adequate conceptually and technically" obtained a mean score of 4.7/5, while "The control is adequate conceptually and technically in most aspects" obtained a mean score of 4.5/5. The statements describing basic adequacy and lack of conceptual and technical adequacy obtained mean scores of 3.5/5 and 2.5/5, respectively.



Figure 3: Workshop invitation digital poster.

Because the ratings were obtained through an oral participatory exercise rather than a validated psychometric instrument, these values were treated as descriptive indicators of perceived adequacy. They were not interpreted as measures of objective technical performance or effectiveness.

3.4. Qualitative perceptions of the proposed control

The qualitative feedback indicated a generally favorable perception of the proposed technological solution. Participants described the project as relevant to the occupational context and associated it with potential contributions to health, self-care, and occupational and personal performance. One participant emphasized that the device could contribute to measuring multiple aspects of the worker's condition. At the same time, participants identified areas requiring further development. One participant considered the device appropriate but recommended additional testing to verify the quality of the indices and data generated by the device. This observation highlights an important distinction between perceived usefulness and the validity or reliability of wearable-derived data. Acceptance of the technology does not, by itself, establish that physiological measurements are sufficiently accurate to support psychosocial risk assessment. Another participant highlighted the need for greater clarity and confidence in the explanations provided to workers during implementation, particularly because opportunities for interaction with informal delivery workers can be difficult to generate.

3.5. Work schedules and contextual interpretation

The participatory process identified the importance of considering the temporal organization of participants' work. Some participants reported working at night or during early-morning hours. This observation suggests that wearable-derived indicators such as sleep quality, stress level, heart rate, and HRV should be interpreted in relation to individual work schedules and circadian patterns. Conventional assumptions regarding daytime work may not adequately represent the working conditions of informal platform-based delivery workers.

3.6. Overall pilot findings

Overall, the pilot findings indicated favorable perceived comfort, ease of use, usefulness, acceptance, and conceptual and technical adequacy of the proposed wearable-based control. At the same time, the participatory process identified three areas requiring further development: verification of the quality of wearable-generated data, contextual interpretation of physiological and behavioral indicators,

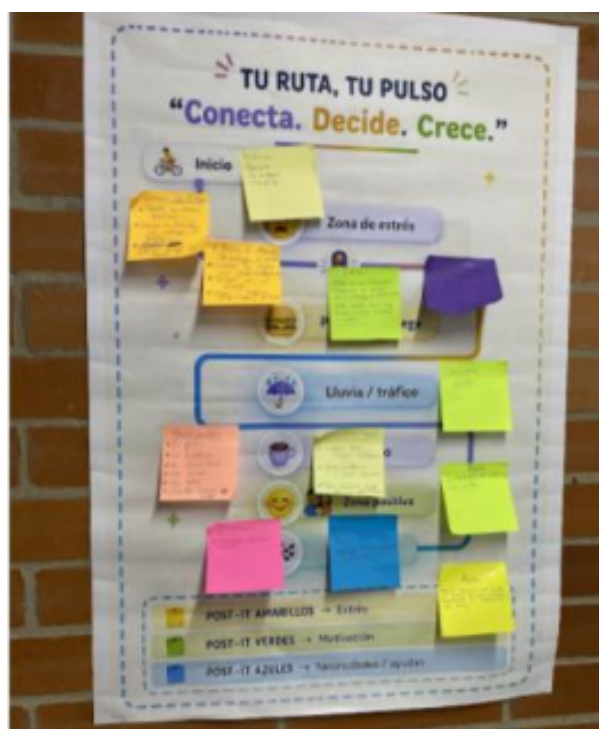


Figure 4: Workshop Qualitative Research Strategy.

and improvement of communication and interaction with workers. The findings therefore provide preliminary evidence of feasibility and user acceptance but do not establish the effectiveness of the approach in reducing psychosocial risk.

4. Discussion

The present pilot study explored the feasibility and user experience associated with an AI-assisted wearable approach for psychosocial risk monitoring among informal bicycle delivery workers affiliated with digital platforms in Bogotá. The findings showed favorable perceptions of comfort, ease of use, usefulness, and acceptance after a three-month period of use. The participatory assessment also produced favorable perceptions of the conceptual and technical adequacy of the proposed control.

The findings should first be understood within the context of the population studied. Informal platform-based delivery workers operate in an occupational environment characterized by mobility, variable schedules, and dependence on digital platforms. The use of a wearable device may therefore provide an opportunity to collect information during real-world work activities rather than relying exclusively on retrospective reports.

The high perceived ease-of-use score (4.5/5) and comfort score (4.4/5) suggest that the device was generally well accepted by the participants during the pilot. This is relevant because the feasibility of wearable-based occupational monitoring depends not only on the technical capacity of the device but also on whether workers are willing and able to use it during their actual working activities.

Perceived usefulness and overall acceptance were also rated 4.5/5. These findings suggest that participants recognized potential value in the technological approach. The qualitative comments reinforce this interpretation, with participants associating the project with health, self-care, and occupational and personal performance.

However, the results also demonstrate why perceived acceptance should not be equated with technological validity. One participant explicitly recommended additional testing to verify the quality of the indices and data generated by the device. This observation is particularly relevant when wearable-derived physiological variables are subsequently interpreted through AI-assisted systems. An AI system



Figure 5: Field implementation of the wearable-based monitoring approach.

Emerging theme	Participant feedback	Implication
Perceived usefulness	Potential contribution to health, self-care and performance	Maintain user-centered functionality
Multiple indicators	Device perceived as capable of measuring different aspects	Potential for multimodal monitoring
Data quality	Need to verify quality of generated indices/data	Independent validation required
Worker interaction	Need for clear explanations and adequate interaction	Improve implementation and communication
Work schedules	Night and early-morning work reported	Incorporate circadian/work-schedule context

Table 4

Main qualitative findings and implications for further development

can organize or interpret information, but the quality of its outputs remains dependent, among other factors, on the quality and validity of the underlying data.

The integration of expert-curated information into the AI-assisted component represents an attempt to address the contextual requirements of psychosocial risk assessment. Rather than treating the AI system as an autonomous diagnostic mechanism, the proposed approach positions artificial intelligence as an interpretive support layer informed by occupational safety and health and organizational psychology expertise. Nevertheless, detailed operational aspects of the AI system are not disclosed in this manuscript due to ongoing validation and potential intellectual property considerations.

Another important finding concerns temporal context. Participants' reports of night and early-

morning work highlight the importance of considering circadian patterns when interpreting physiological and behavioral data. Sleep quality, heart rate, HRV, and perceived stress may have different meanings depending on when a worker performs the activity, when the worker sleeps, and how the individual's work schedule is organized. This issue may be particularly relevant to platform workers, whose schedules may vary according to demand and personal availability.

The participatory component also demonstrated the value of involving workers directly in the development and evaluation of technological controls. The workshop generated information that would be difficult to obtain exclusively through technical assessment, including perceptions concerning self-care, usability, data quality, and the practical conditions required for interaction with workers. The qualitative feedback therefore complemented the quantitative usability scores by identifying specific areas for technological and methodological improvement.

From an occupational safety and health perspective, these findings support a distinction between monitoring and control. The wearable and AI-assisted architecture explored in this study can potentially support the identification and interpretation of information associated with psychosocial risk, but the present study does not demonstrate that the technology itself reduces exposure to psychosocial risk or improves health outcomes.

The study has several limitations. First, the sample comprised only six workers, limiting generalizability. Second, the participatory ratings were collected orally, meaning that individual participant-level responses were not retained for subsequent statistical analysis. Third, the assessment used a participatory five-point agreement scale rather than a validated psychometric instrument. Fourth, the study did not independently validate the physiological measurements generated by the commercial wearable. Fifth, the present findings do not establish the predictive accuracy of the AI-assisted interpretation or its ability to identify psychosocial risk with diagnostic validity. Additionally, the lack of disclosure of the AI system's internal architecture limits external reproducibility at this stage, as the system is under active validation and potential intellectual property protection.

These limitations also define the priorities for future research. Larger samples should be used to assess the reproducibility of the findings. Future studies should retain participant-level data, apply validated usability and psychosocial risk instruments, and establish the validity and reliability of the physiological indicators. Longitudinal research should also investigate whether wearable-derived information can contribute to the early identification of psychosocial risk patterns and whether subsequent interventions produce measurable improvements in occupational outcomes.

5. Conclusions

This pilot study explored an AI-assisted wearable approach for psychosocial risk monitoring among informal bicycle delivery workers affiliated with digital platforms in Bogotá, Colombia.

The six participating workers reported favorable levels of comfort, ease of use, perceived usefulness, and overall acceptance after three months of wearable use. The participatory assessment also indicated favorable perceptions of the conceptual and technical adequacy of the proposed control.

The qualitative findings provided additional evidence of perceived relevance for health and self-care while identifying important areas for improvement, particularly the verification of wearable-generated data and the need to interpret physiological indicators according to workers' schedules and circadian patterns.

The findings support the feasibility of continuing the development of an integrated wearable and AI-assisted approach to psychosocial risk monitoring. However, the study should be considered preliminary. It does not establish the technical validity of the physiological measurements, the diagnostic validity of the AI-assisted interpretation

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Declaration on Generative AI

During the preparation of this work, the authors used ChatGPT and Gemini for grammar and spelling checks, translation from Spanish, and language naturalization. Further, the authors used Canva for figures to generate images upon given instructions. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

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