

Location-based Mobile Interventions for Alcohol Consumption in Mexican Youth: Perceived Usefulness and Ease of Use

Intervenciones Móviles basadas en Ubicación para el Consumo de Alcohol en Jóvenes Mexicanos: Utilidad y Facilidad de Uso Percibida

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Abstract

In Mexico, addressing risky alcohol consumption and binge drinking among youth represents a critical public health challenge, with significant implications for both physical and mental health. This study explores the potential of mobile interventions, particularly location-based interventions and conversational agents, to mitigate alcohol misuse among Mexican youth, with the potential to integrate these technologies into existing healthcare systems. We conducted a comprehensive review of the literature on mHealth interventions and geofencing technologies, with a focus on their clinical relevance and applicability. Leveraging emerging technologies, we developed a mobile platform for location-based interventions that monitors and provides feedback on alcohol consumption patterns. We recruited 38 participants (10 women, 28 men) to evaluate the platform's perceived ease of use and usefulness using the Technology Acceptance Model (TAM). Overall, perceived usefulness (PU) and perceived ease of use (PEoU) scores were positive. While women rated the platform slightly higher, only two items revealed significant gender differences across all items. Our findings highlight the promising role of mobile interventions in augmenting traditional clinical strategies, offering personalized support to young individuals at risk of developing alcohol use disorders. Furthermore, we discuss the potential applications of these technologies in addressing other psychological disorders, underscoring their versatility in mental health care. This study contributes to the growing body of evidence supporting the integration of technology into public health initiatives, particularly in emerging economies like Mexico.

Resumen. En México, abordar el consumo riesgoso de alcohol y el consumo excesivo de alcohol en jóvenes representa un desafío crítico de salud pública, con implicaciones significativas tanto para la salud física como mental. Este estudio explora el potencial de las intervenciones móviles, en particular intervenciones basadas en ubicación y agentes conversacionales, para mitigar el uso nocivo de alcohol en la población juvenil mexicana, con el objetivo de integrar estas tecnologías en los sistemas de salud existentes. Realizamos una revisión exhaustiva de la literatura sobre intervenciones de eSalud (salud móvil) y tecnologías de geolocalización, enfatizando su relevancia clínica. Aprovechando tecnologías emergentes, desarrollamos una plataforma móvil para intervenciones basadas en ubicación geográfica, diseñada para monitorear y brindar retroalimentación sobre los patrones de consumo de alcohol. Reclutamos a 38 participantes (10 mujeres, 28 hombres) para evaluar la facilidad de uso percibida y la utilidad de la plataforma mediante el Technology Acceptance Model (TAM). En general, las puntuaciones de utilidad percibida (PU) y facilidad de uso percibida (PEoU) fueron positivas. Aunque las mujeres valoraron la plataforma ligeramente más alto, no se encontraron diferencias de género significativas en las puntuaciones generales ($p > 0.05$). Nuestros hallazgos resaltan el papel prometedor de las intervenciones móviles para complementar estrategias clínicas tradicionales, ofreciendo apoyo personalizado a jóvenes en riesgo de desarrollar trastornos por consumo de alcohol. Además, discutimos las aplicaciones potenciales de estas tecnologías en otros trastornos psicológicos, subrayando su versatilidad en el ámbito de la salud mental. Este estudio contribuye al creciente cuerpo de evidencia que respalda la integración de tecnología en iniciativas de salud pública, particularmente en economías emergentes como México.

Keywords: Human-computer interaction, Mexican youth drinking, Mobile alcohol interventions, Geofencing, Technology Acceptance Model (TAM), mHealth. (*Palabras clave:* Consumo de alcohol en jóvenes mexicanos, Interacción humano-computadora, Intervenciones móviles para consumo de alcohol, Geovalla, Technology Acceptance Model (TAM), mHealth.)

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1. Introduction

Risky alcohol consumption and binge drinking among youth in Mexico are critical public health concerns with far-reaching consequences. According to the World Health Organization (WHO), binge drinking refers to consuming five or more drinks on a single occasion for men and four or more for women [1]. This behavior remains alarmingly prevalent; recent data from 2022 indicates that the prevalence of alcohol consumption in

the Mexican adolescent population (10 to 19 years) is approximately 20.6% [2]. Alcohol Use Disorder (AUD) is classified by major medical organizations, including the WHO and the American Psychiatric Association (APA), as a chronic neurobiological disease characterized by altered brain function and long-term cognitive changes [1][3].

This problem is influenced by multifaceted factors, including family dynamics, where parental consumption increases risk [4], and evolving gender norms. While historically prevalent among men, recent studies indicate a convergence in drinking patterns [5], though gender-specific traits like impulsivity may still contribute to different rates of binge drinking [6]. Furthermore, the environment is a key factor. Risky alcohol drinking locations, such as party settings, are associated with more severe adverse consequences [7] by reducing supervision and social control [8].

Current treatment programs in Mexico encounter significant challenges in reaching and engaging youth populations. Barriers include the stigma associated with seeking help, structural issues like limited access in rural or underserved regions [9], and a disconnect from cultural norms. For instance, studies indicate Mexican teenagers may prefer indirect or passive refusal techniques over the assertive strategies taught in some programs [10]. This highlights the challenge of adapting interventions, such as the *Keepin' it REAL* program, to the specific cultural context of Mexico [11].

Mobile interventions (mHealth) present a promising avenue to overcome these barriers, offering scalable, cost-effective, and accessible platforms [12]. The literature supports their potential, with AI-powered chatbots and conversational agents enabling personalized and interactive experiences [18]. Specific applications have demonstrated positive effects. The *TeleCoach* app demonstrated success among students with heavy drinking patterns [13], and the *Drink Less* app, functioning as a self-help tool, showed that features like goal setting and cognitive-behavioral techniques could lead to reductions in alcohol intake [14][15].

Two technologies are particularly relevant to our approach. First, location-based technologies (geofencing) enable context-aware, "just-in-time" interventions. Studies have shown that sending notifications to users entering predefined high-risk areas can significantly decrease binge drinking episodes [16] and improve adherence to reduction strategies [17]. Second, conversational agents (i.e., chatbots) offer interactive support. While advanced AI-driven chatbots can deliver Cognitive Behavioral Therapy (CBT) [20], a more controlled finite-state machine approach, as used in this work, can offer therapist-validated strategies [19].

Despite this global potential, research on mHealth for alcohol misuse in Mexico remains scarce. This manuscript reports on the evaluation of a mobile platform designed for Mexican university students. The intervention integrates geofencing for high-risk environments and a conversational agent, both of which leverage culturally sensitive design informed by professional consultations and literature [21][22]. We evaluated its perceived usefulness and ease of use via the Technology Ac-

ceptance Model (TAM) [23] to inform the design of effective, tailored interventions.

Ultimately, the main contribution of this study is the integration of geofencing and a culturally-adapted conversational agent to provide just-in-time support for alcohol misuse in the specific context of Mexican university students. Unlike existing mHealth tools, our approach fills a critical gap in localized research by tailoring both the intervention delivery (context-aware) and the dialogue system (culturally-sensitive) for a demographic underserved by digital health initiatives in emerging economies.

2. Materials and Methods

2.1 Mobile platform for alcohol consumption patterns

Following brainstorming sessions with two professionals who lead substance abuse intervention programs at a public institute in Northwest Mexico, we envisioned and developed our intervention strategies. These professionals emphasized the importance of integrating informal language, leveraging positive reinforcement techniques, and explicitly referencing participants' families within our intervention design. We used these insights to determine the following functional requirements:

FR1: The system must consider the type of language regarded as informal according to the cultural and social characteristics of the target population.

FR2: The system must use messages with positive connotations, avoiding threats or negative meanings in general, especially when dealing with young people.

FR3: The system must include references to family or community in its messages.

Regarding the messages the participants should receive, examples of FR1 messages in the app, as suggested by the professionals, include: "*Reflect on the positive changes you've experienced since reducing your drinking,*" and "*Maintaining sobriety helps strengthen your family relationships.*" Conversely, for FR2, some examples of messages are: "*Recognize how far you've come in your journey to cut back on alcohol,*" and "*Remember that your family supports you. You are not alone.*" Also, for FR3, some examples of messages in the interventions are: "*Notice how much more you enjoy time with friends when alcohol isn't involved,*" and "*Sobriety has brought you closer to your family—cherish these moments.*"

Figure 1 shows a screenshot of the mobile application and the chatbot developed for mobile interventions. The figure shows a map where participants must mark their alcohol-risky locations. Users must consent to location data collection during the app's initial setup. The app utilizes GPS technology to track users' locations, allowing it to send location-based notifications when they enter predefined geofenced areas known for personal risky alcohol consumption. All data collection and usage comply with privacy regulations, ensuring that user data is secure and used solely for the intended purpose. The application then sends location-based notifications when the user is nearby or interacts with the area. The participant can decide to interact with the notification message, where the conversational

agent can provide a follow-up on the intervention.

Figure 2 shows the architectural model of the mobile platform. It includes a mobile application developed in Kotlin (version 1.8) within the Android Studio IDE Flamingo (version 2022.2.1), which leverages the Google Maps API for real-time data collection. The platform was developed exclusively for the Android OS for this initial prototype. This decision was based on (1) the high market penetration of Android within the target demographic (university students in Mexico) and (2) the resource constraints of this feasibility study, allowing for rapid prototyping and testing of the core geofencing functionality. Firebase supports backend infrastructure, while a Python-based (version 3.11). A Telegram chatbot provides personalized interventions. The main components are described as follows:

Android Application: Developed using Kotlin within the Android Studio IDE, the mobile application serves as the primary interface for users. It collects and analyzes data relevant to risky alcohol consumption patterns among Mexican youth. The application utilizes the Google Maps API for geolocation. The geofencing strategy was implemented using the Google Maps Geofencing API. Each 'Risky Location' defined by the user created a geofence with a 100-meter radius. To optimize battery consumption, alerts were not based on high-frequency GPS polling. Instead, we utilized the `GEOFENCE_TRANSITION_ENTER` trigger, which is managed efficiently by Google Play Services. The system was configured with `setInitialTrigger(GEOFENCE_TRANSITION_ENTER)` to notify the user if they were already inside a zone upon registration. `EXIT` or `DWELL` transitions were not used in this prototype.

Privacy compliance was critical. The application explicitly requested `ACCESS_FINE_LOCATION` and `ACCESS_BACKGROUND_LOCATION` permissions, with a clear explanation of their necessity for contextual alerts. All location data was transmitted to Firebase via HTTPS and stored encrypted at rest, in compliance with Mexico's Federal Law on Protection of Personal Data Held by Private Parties (LF-PDPPP). User data was anonymized on the backend, and users maintained control to delete their risk locations at any time. The intervention module comprises a repository of approximately 40 text-based interventions, designed from evidence-based protocols derived from clinical literature and therapist recommendations obtained during design sessions. These interventions were subsequently culturally and regionally adapted for local jargon. Data processing and storage occur securely in a cloud-based infrastructure.

Firebase: Firebase served as the Backend-as-a-Service (BaaS) for the platform. We utilized Firebase Authentication to manage user registration and login securely. Additionally, a Firebase database was used to store user interaction data generated when geofences were triggered. Firebase provided the necessary backend tools for secure authentication and data storage, ensuring efficient processing of collected data.

Chatbot: Integrated into the application, the Telegram chatbot provides personalized follow-ups through a keyword-

triggered interaction system following the three-phase conversation flow detailed in Table 1. Developed using Python (version 3.11) and the `python-telegram-bot` (version 13.13) library, the chatbot identifies user messages (in Spanish) containing alcohol-related terms (e.g., `beber`, `consumir`, `tomar`). The chatbot's logic was implemented as a basic finite-state machine, using regular expressions (regex) to identify keywords and respond with therapist-validated strategies tailored to Mexican youth. These responses, co-designed with therapists during design sessions and culturally adapted for local pertinence, include: (1) harm reduction techniques, (2) motivational prompts, and (3) a crisis support protocol. As detailed in Table 1, when high-risk keywords (e.g., `'ayuda'`, `'emergencia'`) were detected, the bot was programmed to bypass the standard intervention flow and respond with a message urging the user to contact emergency services (e.g., 911 in Mexico) or a trusted friend or family member. By delivering context-aware guidance in a user-friendly format, the chatbot enhances engagement while providing additional avenues for intervention delivery.

Table 1. Conversation flow architecture of the alcohol intervention chatbot.

The writing of the intervention messages (i.e., mobile notifications) considers regional, conversational language, and idioms. This included using familiar, informal language and references that resonate with Mexican youth, as well as integrating culturally specific examples and scenarios related to alcohol consumption. Additionally, the app's design and features were tailored to reflect cultural preferences and sensitivities regarding alcohol use, such as the importance of family and community support in promoting responsible drinking habits.

During the development of our application, we conducted formal and informal consultations with mental health professionals and considered relevant academic literature to inform our intervention methodologies, as referenced in [21, 22]. Insights gained from these sessions highlighted the efficacy of employing conversational language to establish rapport and enhance user engagement, fostering a sense of familiarity and trust akin to conversing with a peer rather than a clinical entity. Additionally, the literature stressed the importance of understanding risky alcohol-drinking locations, as identified in previous studies. Recognizing where individuals are more prone to engage in excessive drinking can result in targeted interventions and promote responsible drinking habits.

To validate the potential adoption by the target population, we designed a study with university students. The eligibility criterion for participation was alcohol consumption. Invitations to participate were distributed via mass institutional email to the general student body, encouraging participation from both male and female students. The final sample consisted of 38 participants who voluntarily attended the session (10 women, 28 men), aged between 18 and 25 years old, at a local public university in Northwest Mexico. This gender imbalance reflects the voluntary response to the open invitation. The session consisted of an introduction to the study and the participants' alcohol consumption habits, a live demo of the platform, and fi-

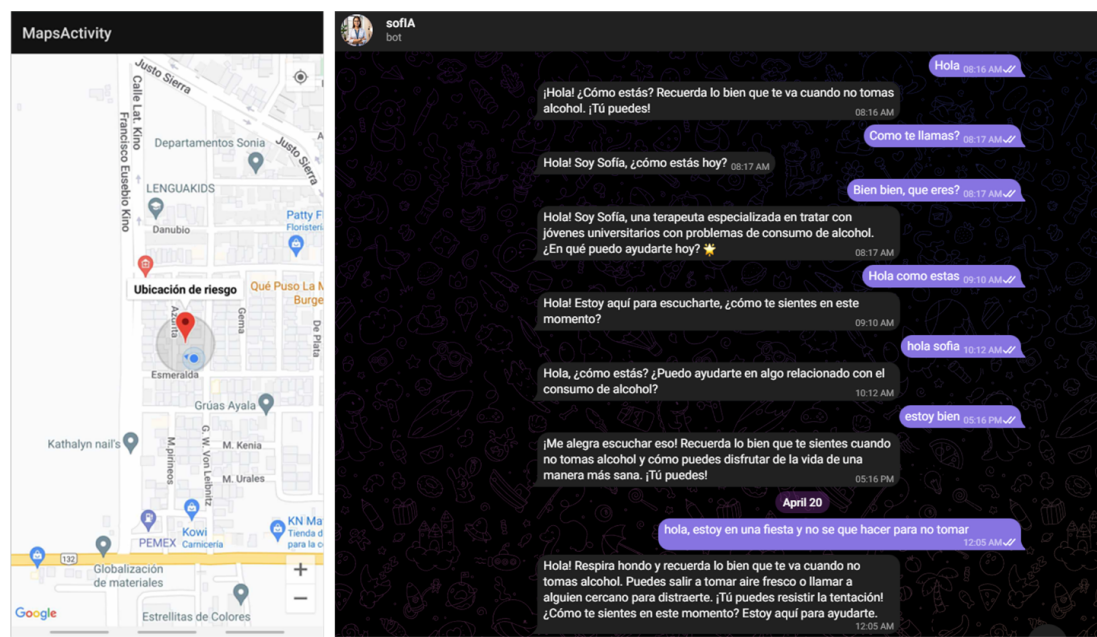


Figure 1. Mobile application risky location feature (left) and chatbot (right). The text is in Spanish, as the study was conducted with native Spanish speakers in Mexico.

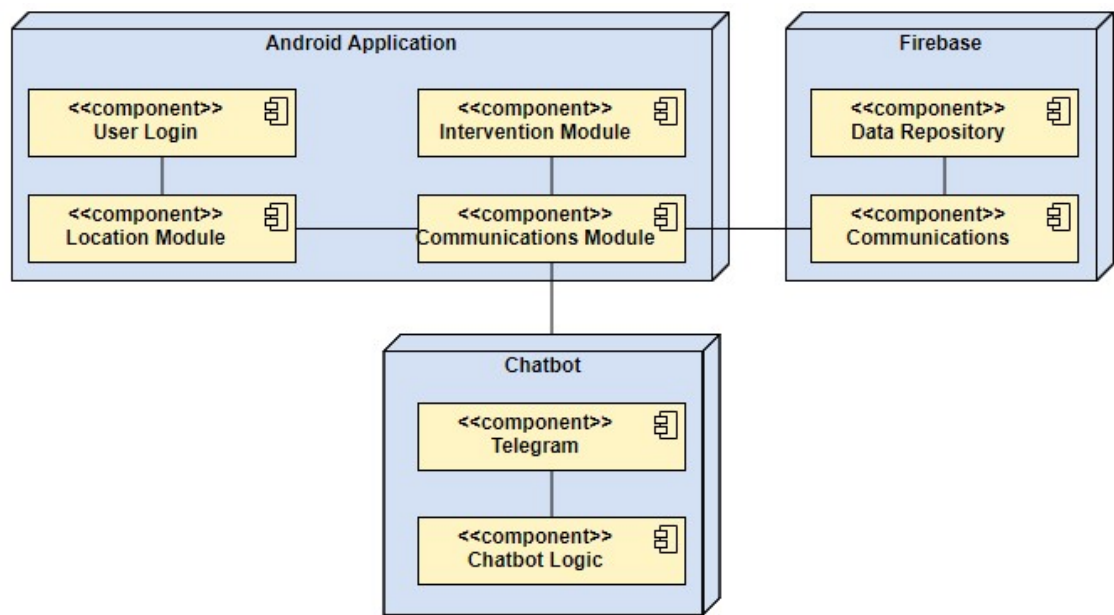


Figure 2. Mobile application architecture

nally, administering a questionnaire to assess the platform. All participants signed an informed consent after being introduced to the study.

In the session, first, participants completed the Alcohol Use Disorders Identification Test (AUDIT). Then, we presented a live demo of the mobile sensing application, which identifies patterns of alcohol consumption based on locations associated with risky drinking. To achieve this, we designed a guided tour of the university campus. For the demo, we labeled some

buildings as risky locations associated with alcohol consumption. As the participants walked by the campus, they tested the type of text-based intervention (i.e., mobile notification) when interacting with said locations by entering their vicinity. Also, we asked participants to interact with the alcohol consumption chatbot through Telegram. Finally, participants completed an online questionnaire evaluating the perceived usefulness and ease of use scales of the Technology Acceptance Model (TAM) proposed by Davis [23], which focuses on perceived useful-

Interaction Phase	User Input Triggers	Chatbot Response System	Example Exchange
Greetings Bank	Initial contact/salutations (e.g., "Hola", "¿Qué hace este bot?")	Delivers a welcome message + brief explanation of purpose	User: "Hola" → Bot: "¡Bienvenido/a! Soy tu asistente para manejo del consumo de alcohol."
Small Talk Bank	General conversation (e.g., "¿Cómo estás?", "¿Qué haces?")	Maintains engagement with neutral replies; steers toward alcohol-related topics	User: "¿Qué haces?" → Bot: "Estoy aquí para apoyarte. ¿Has tenido situaciones recientes donde bebiste alcohol?"
Intervention Bank	Alcohol-related keywords (e.g., "beber", "borracho/a", "tomar", "cruda")	Activates evidence-based strategies: 1. Harm Reduction: "¿Has pensado en alternar bebidas alcohólicas con agua?" 2. Motivational: "Suenas preocupado/a. ¿Qué te gustaría cambiar?" 3. Crisis Support: "Si necesitas ayuda urgente, márcale a un familiar o amigo"	User: "Ayer tomé demasiado" → Bot: "Entiendo. ¿Sabías que poner límites antes de salir ayuda? Ejemplo: 'Hoy solo tomaré 3 bebidas.' ¿Quieres probarlo?"

ness and ease of use as primary factors influencing technology adoption (see Appendix 1). This model was selected due to its widespread application and proven reliability in health-related interventions. The scale was a 7-point Likert (1 = Completely agree; 7 = Completely disagree). The survey results were analyzed using IBM's SPSS (version 22) and the Mann-Whitney U test for ordinal scales.

3. Results and Discussion

Analysis of the responses revealed consistent overall perceptions among women and men regarding the Perceived Usefulness (items 1-6) and Perceived Ease of Use (items 7-12) of the mobile application (Table 2). In terms of Perceived Usefulness (PU), women reported higher levels of positive responses. As Table 2 shows, most women were positive about the chatbot. Only three items received negative assessments from women (items 1, 3, and 4), with 30%, 10%, and 10% of women, respectively, rating the chatbot negatively. Most women had a positive regard for the chatbot, whereas men were more critical, and responses were generally more spread out across the 7-point scale.

Upon further scrutiny, we found significant differences between women and men in some of the responses to the TAM instrument. The differences were related to the use of a mobile application to track alcohol consumption, ease of learning to use the app, and clarity of interaction (items 5 and 9). Gender-specific social norms, cultural attitudes towards alcohol, and individual experiences and preferences could influence these differences. For instance, women may be more inclined to use the app to identify patterns in their alcohol consumption. They may find learning to use it more straightforward, driven by a higher level of health consciousness and motivation for self-monitoring behaviors. Conversely, men might exhibit less interest or perceive the app as less clear and understandable, potentially facing less stigma and viewing tracking as less necessary than women. These findings suggest the potential adoption of the proposed technology in monitoring alcohol consumption among Mexican university students. Women were generally more optimistic about the usefulness and ease of use of items. Future research could further explore cultural and educational factors that contribute to this perception and its implications for tailoring technology to meet the needs of

Mexican university students.

The overall perception of perceived ease of use and usefulness of female and male university students highlights the robustness and relevance of the technology designed for monitoring alcohol consumption patterns. These findings indicate that the technology resonated equally with both genders within this specific demographic, which is particularly significant in the cultural context of Mexico, where societal and cultural norms can influence technology acceptance differently among men and women. For instance, using conversational, idiomatic language, coupled with women's heightened health consciousness and motivation for self-monitoring behaviors, may contribute to women's perceived ease of use and usefulness compared to men. By recognizing and acknowledging the shared perceptions of women and men, developers and policymakers can tailor interventions more effectively, ensuring they are well-received by a broader audience.

Despite these technical challenges, the results from the usefulness and ease of use questionnaire provide valuable insights into participants' perceptions regarding the mobile application's potential impact on their alcohol consumption habits. Participants generally believe that using the mobile application would improve their ability to reduce or control alcohol consumption, with the median responses indicating slightly higher perceptions among women. However, this difference is not statistically significant.

It is important to note that while men and women generally perceived the platform positively, we observed some differences in certain items. For instance, women rated the application's potential to track alcohol consumption and see progress over time significantly higher than men, suggesting a greater belief in its efficacy for self-monitoring. Similarly, women also rated the application more positively in terms of its ability to identify patterns in alcohol consumption and the situations that trigger it, indicating a stronger belief in its effectiveness for behavior identification. Also, women report that learning to use the application would be easier for them than men, with a significant gender difference observed in this aspect. Moreover, women anticipate a more straightforward and understandable interaction with the application than men, with a significant statistical difference. These findings highlight gender-specific attitudes and beliefs regarding the mobile application's useful-

Table 2. TAM items and analysis. Items in bold are statistically significant at 0.05.

		Women (N=10)										Men (N=28)											
Item		1	2	3	4	5	6	7	Mdn	IQR	1	2	3	4	5	6	7	Mdn	IQR	Mann-Whitney U			
		1	2	1	4	0	2	1	0	3	3	2	8	7	4	4	3	0	3		3		
Perceived Usefulness (PU)	1	2	2	4	0	2	1	0	3	3	2	8	7	4	4	3	0	3	3	U = 134.5, p = .858, $\eta^2 = 0.001$, d = 0.059			
	2	2	4	3	1	0	0	0	2	1	6	5	5	7	3	2	0	3	2	U = 100, p = .194, $\eta^2 = 0.046$, d = 0.441			
	3	3	4	2	0	1	0	0	2	2	6	3	9	4	2	2	2	3	2	U = 89, p = .095, $\eta^2 = 0.075$, d = 0.570			
	4	7	2	0	0	1	0	0	1	1	13	7	2	1	1	2	2	2	2	U = 102, p = .218, $\eta^2 = 0.042$, d = 0.418			
	5	7	3	0	0	0	0	0	1	1	9	10	1	4	0	3	1	2	3	U = 73.5, p = .026, $\eta^2 = 0.128$, d = 0.766			
Perceived Ease of Use (PEoU)	6	3	4	3	0	0	0	0	2	2	5	8	8	3	3	0	1	3	2	U = 94.5, p = .133, $\eta^2 = 0.06$, d = 0.505			
	7	10	0	0	0	0	0	0	1	0	17	3	2	0	2	2	2	1	2	U = 85, p = .070, $\eta^2 = 0.087$, d = 0.619			
	8	7	2	1	0	0	0	0	1	1	13	5	3	2	2	2	1	2	3	U = 96, p = .151, $\eta^2 = 0.056$, d = 0.487			
	9	7	3	0	0	0	0	0	1	1	9	9	4	1	2	2	1	2	2	U = 72, p = .023, $\eta^2 = 0.134$, d = 0.786			
	10	6	2	2	0	0	0	0	1	1	12	4	5	1	3	0	3	2	3	U = 101, p = .205, $\eta^2 = 0.044$, d = 0.429			
	11	9	0	1	0	0	0	0	1	0	16	3	2	2	1	3	1	1	3	U = 92, p = .116, $\eta^2 = 0.067$, d = 0.534			
	12	9	1	0	0	0	0	0	1	0	17	2	2	1	2	2	2	1	3	U = 94.5, p = .133, $\eta^2 = 0.06$, d = 0.505			
Mdn=Median																							

ness and ease of use, emphasizing the importance of tailoring interventions to accommodate diverse user preferences. While our findings indicate significant gender differences in the acceptance and effectiveness of the intervention, the underlying factors driving these differences remain unclear. Previous studies have shown that men and women may respond differently to health interventions due to various psychological, social, and cultural factors [24, 25]. Further research is necessary to explore these factors in the context of mobile interventions for alcohol consumption in Mexican youth, which will help refine and tailor strategies to enhance their efficacy across different demographic groups. Tailoring interventions to accommodate gender-specific needs and preferences may improve their effectiveness and usability among diverse user groups.

To further refine the design of future interventions, it is crucial to interpret our gender-specific findings within the context of the study’s scope. As explicitly acknowledged in the limitations section, the small and unbalanced sample (N=38, with only 10 women) means that the observed differences should be interpreted with caution. The non-probabilistic and voluntary nature of the recruitment process may have introduced bias. Thus, these results serve as a foundation for future large-scale, longitudinal studies rather than definitive generalizations for the entire Mexican youth population at this point. This need for a more inclusive approach is further underscored by practical implementation challenges, such as interrupted chatbot conversational flows and device accessibility barriers for iPhone users, which must be addressed to ensure broader reach and engagement.

Nevertheless, the platform’s technical and ethical integrity remains a fundamental strength. The implementation of Firebase as a secure Backend-as-a-Service, combined with the 100-meter geofencing configuration, provided the necessary reliability for real-time monitoring in diverse environments. More importantly, from an ethical perspective, the integration of a crisis support protocol and strict adherence to Mexico’s LFPDPPP regulations for data encryption and privacy were essential to ensure participant safety. These robust technical and ethical foundations are critical for building the trust required to deploy digital health interventions effectively in sensitive areas like alcohol misuse among youth.

In addition, these results offer valuable insights for personalizing mobile interventions using emerging technologies, such as chatbot responses and prompts, to enhance their effectiveness. For instance, chatbots can be programmed to provide personalized or individualized responses and prompts. By incorporating language and messaging that resonate with each specific gender, chatbots can enhance engagement and acceptance. Additionally, chatbots should consider that women tend to prefer more informal conversations via text messages than men [27]. Chatbot responses and prompts can reflect an understanding of cultural nuances and address potential gender-specific concerns or preferences, ensuring that interventions are well-received by diverse university populations.

Recognizing potential variations in perception across diverse regions in Mexico, chatbots can adapt their responses

and prompts to cater to the specific needs and preferences of different university demographics. Chatbots can personalize interventions to better align with the cultural and behavioral aspects of university communities by incorporating regional dialects, cultural references, and contextual information. In addition, chatbots can serve as a valuable tool for collecting continuous user feedback and iteratively refining interventions based on user responses and preferences. By analyzing chatbot interactions and user feedback, developers and stakeholders can identify areas for improvement and adjust their approach to enhance the effectiveness and relevance of mobile interventions over time.

Beyond alcohol misuse, mobile health interventions have been explored in the treatment of other psychological disorders. AI-driven chatbots have successfully delivered cognitive behavioral therapy (CBT) interventions for anxiety and depression, demonstrating comparable effectiveness to therapist-led approaches [20]. Similarly, geofencing has been integrated into trauma-informed treatments for HIV patients, providing real-time coping mechanisms to individuals with trauma-related triggers [26]. Given the overlap between substance use disorders and mental health conditions, future research should investigate how mobile interventions, like the one proposed in this manuscript, can be expanded to address co-occurring psychiatric disorders. However, implementation challenges persist. While the cited studies demonstrate efficacy in middle to high-income settings, our Mexican context requires specific adaptations to less favored regions of the country. Cultural adaptation, such as translating CBT concepts into colloquial Spanish idioms, is essential. Privacy concerns also escalate in communities where device sharing is common. Nevertheless, Mexico's youth smartphone penetration creates unique opportunities for tech-enabled mental healthcare.

4. Limitations

Several limitations should be considered when interpreting the findings of this study. First, it is essential to note that the platform evaluated was a functional prototype and not fully developed at this stage. The study design was cross-sectional, relying on a single-session demonstration rather than longitudinal use. Consequently, our evaluation focused on the perceived usefulness and ease of use (TAM) following a brief exposure, rather than on the platform's actual effectiveness in reducing alcohol consumption or long-term user engagement.

Second, the sample size was small ($N = 38$), non-probabilistic, and recruited from a single institution in North-west Mexico, which limits the generalizability of the findings. Furthermore, the sample had a significant gender imbalance (10 women, 28 men). As detailed in our methods, this imbalance reflects the voluntary response to an open institutional invitation. While we analyzed gender differences, the small number of female participants means these findings must be interpreted with caution.

Third, technical and accessibility limitations were identified. The platform was developed exclusively for the Android operating system, which excluded iPhone users. Additionally, during

the study, challenges arose with the chatbot's conversational flow, which could have impacted user perceptions. Finally, the data relied on self-report questionnaires (TAM and AUDIT), which may be subject to social desirability or recall bias.

5. Future Work

Based on the results and limitations of this study, our future work will proceed in several key directions. First, we will address the limitations of the prototype by deploying the platform in real-world settings to assess its effectiveness in reducing alcohol consumption in longitudinal studies, rather than a single session. Second, we plan to enhance the conversational agent. The prototype evaluated in this study used a finite-state machine. Our current development version now includes an LLM-powered chatbot, which will be assessed in future studies to determine if it increases user engagement and provides more personalized support. Finally, further investigation is needed to explore the design of text-based interventions and determine the most effective types of messages for behavior change. By addressing these points and advancing research in this area, we can continue to drive innovation and make meaningful strides toward improving population health outcomes.

6. Conclusions

Our work aimed to contribute by identifying the perceptions of Mexican university students regarding the ease of use and usefulness of mobile interventions for addressing youth alcohol misuse. The findings underscore the importance of integrating personalized mobile interventions into comprehensive population health strategies aimed at mitigating excessive alcohol consumption among young populations. By recognizing the potential of technology to engage and empower individuals in managing their health behaviors, policymakers and practitioners can advocate for the widespread adoption of digital interventions as part of holistic approaches to population health promotion.

However, these interventions must be integrated into Mexico's healthcare system to be effective on a larger scale. Public health services face significant barriers, including limited mental health resources, unequal healthcare access, and stigma surrounding substance use treatment. Mobile health technologies offer a promising solution by providing remote support, real-time monitoring, and tailored intervention strategies for high-risk populations. Collaboration with healthcare institutions, policymakers, and mental health professionals will be essential to ensuring that digital interventions complement, rather than replace, existing prevention and treatment programs.

This study advocates for continued collaboration and innovation in the development and implementation of digital interventions to improve population health outcomes worldwide. There is a clear need for ongoing efforts to leverage emerging technologies and evidence-based approaches to address complex public health challenges. By fostering partnerships between academia, industry, and government agencies, we can harness the full potential of digital interventions to create scalable and sustainable solutions that positively impact population

health on a global scale.

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9. Author Contributions (CRediT)

Gutierrez, L.J.: Conceptualization; Methodology; Investigation; Software; Validation; Formal Analysis; Data curation; Visualization; Writing – original draft. **Castro, L.A.:** Conceptualization; Resources; Writing – review & editing; Project administration; Funding acquisition. **Banos, O.:** Conceptualization; Methodology; Writing – review & editing; Supervision.

10. Conflict of Interest

The authors declare no competing interests.

11. Data Availability Statement

The data are available from the corresponding author upon reasonable request.

12. Bioethics

This study abided by local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

13. Artificial Intelligence Use Disclosure

The authors disclose the use of generative AI tools during the preparation of this manuscript. Generative AI was used exclusively for grammar, spelling, and stylistic refinement across all sections of the paper.

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Table 3. Appendix 1

	Item
Overall Perceived Usefulness (PU)	1. I believe that using this mobile application would improve my ability to reduce or control my alcohol consumption. 2. Using this mobile application would help me have a healthier relationship with alcohol. 3. Using this mobile application would provide me with useful tools to reduce or control my alcohol consumption. 4. Using this mobile application would allow me to track my alcohol consumption and see my progress over time. 5. Using this mobile application would help me identify patterns in my alcohol consumption and the situations that trigger it. 6. Using this mobile application would provide me with support to stay motivated in my efforts to reduce or control my alcohol consumption.
Perceived Ease of Use (PEoU)	7. Learning to use this mobile application would be easy for me. 8. It would be easy for me to use this mobile application to record my alcohol consumption. 9. My interaction with this mobile application would be clear and understandable 10. Using this mobile application would require minimal effort. 11. It would be easy for me to acquire skill in using this mobile application. 12. I would find this mobile application easy to use.