

# **Involving end users in adapting the Spanish version of the Mental Health eClinic for young people in Colombia: A pilot study using participatory design methodologies**

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# Involving end users in adapting the Spanish version of the Mental Health eClinic for young people in Colombia: A pilot study using participatory design methodologies

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## Abstract

**Background:** Health information technologies (HIT) hold enormous promise for improving access to, and better quality, mental health care. However, despite rapid spread of such technologies in high-income countries, they have not yet been commonly adopted in low and middle-income countries. People living in these parts of the world are at risk of experiencing not only physical but also technological and social health inequalities. One possible solution is to utilise already available (and successfully implemented) HITs developed in other countries.

**Objective:** Using participatory design methodologies with Colombian end users (young people, their supportive others, health professionals), this study aimed to: conduct co-design workshops to culturally adapt an online mental health clinic (MHeC) for young people; perform one-on-one user testing sessions to evaluate an alpha prototype of a Spanish version of the MHeC, and adapt it to the Colombian context; and, inform the development of a skeletal framework and alpha prototype for a Colombian version of the MHeC (MHeC-C).

**Methods:** Utilisation of a research and development (R&D) cycle including four iterative phases: co-design workshops; knowledge translation; tailoring to language, culture and place (or context); rapid prototyping; and then, one-on-one user testing sessions.

**Results:** Two co-design workshops were held with 18 users (young people n=7, health professionals n=11). A total of 10 participated in one-on-one user-testing sessions (young people n=5, supportive others n=2, health professionals n=3). 203 source documents were collected and 605 annotations were coded. A thematic analysis resulted in six main themes (i.e. opinions about the MHeC-C, Colombian context, functionality, content, user interface and technology platforms). Participants liked the idea of having a MHeC specially designed and adapted for Colombian young people and its five key elements were acceptable in this context (home page and triage system, self-report assessment, dashboard of results, booking and video visit system and personalized well-being plan). However, to be relevant in Colombia, participants stressed the need to develop some additional functionality (eg. phone network backup, chat, geolocation, and integration with electronic medical records, apps or e-tools) as well as adaptation of the self-report assessment. Importantly, the latter not only included language but also culture and context.

**Conclusions:** The application of an iterative R&D cycle that also included processes for adaptation to Colombia (language, culture, context), resulted in the development of an evidence-based, language-appropriate, culturally-sensitive, context-adapted HIT that is relevant, applicable, engaging and usable in both the short- and longer-term. The resultant R&D cycle allowed for the adaptation of an already available HIT (i.e. MHeC) to the MHeC-C – a low-cost and scalable technology solution for low-to-middle income countries such as Colombia, which has the potential to provide young people with accessible, available, affordable and integrated mental health care at the right time.

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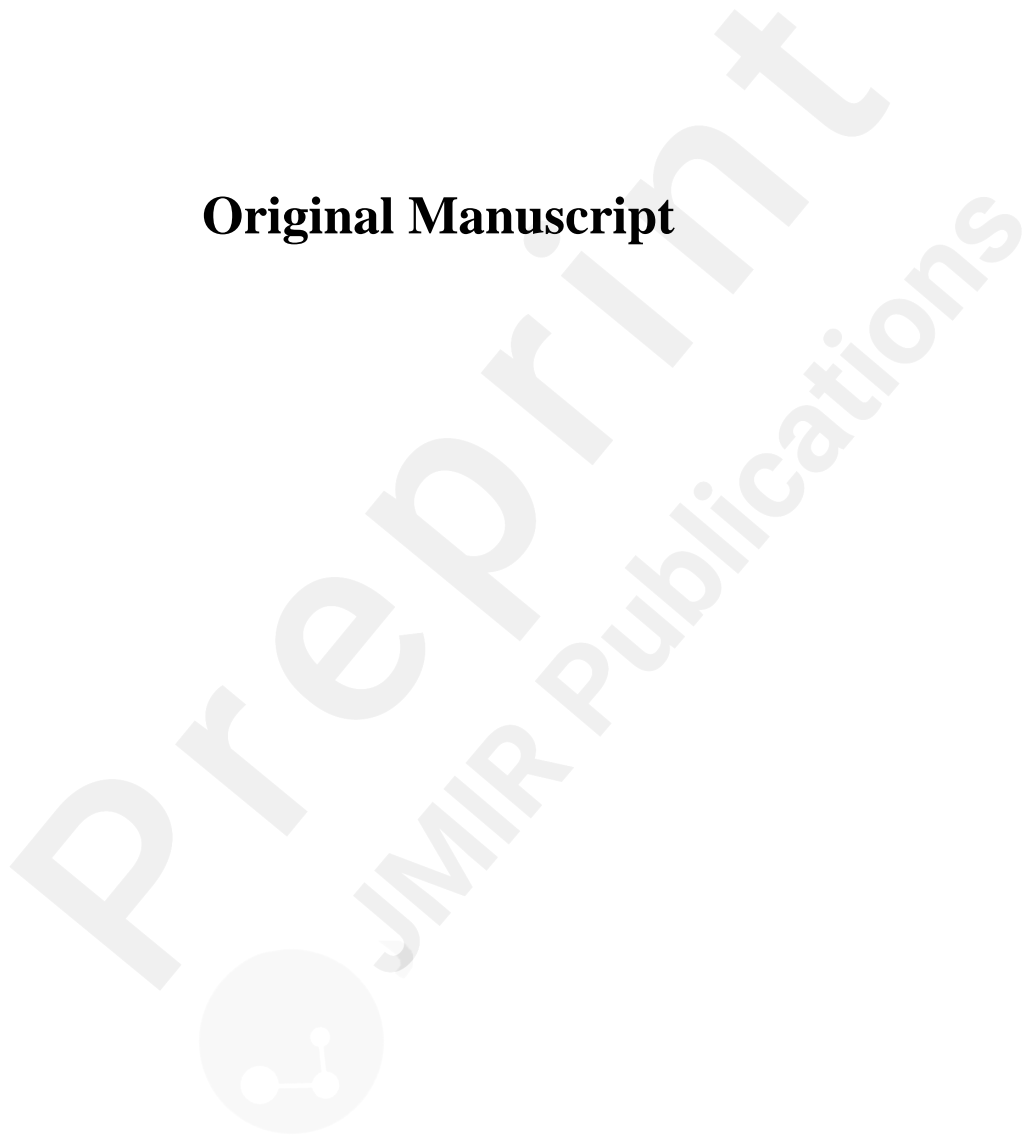
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**Original Manuscript**



## Original Paper

# Involving end users in adapting the Spanish version of the Mental Health eClinic for young people in Colombia: A pilot study using participatory design methodologies

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## Abstract

### Background

Health information technologies (HIT) hold enormous promise for improving access to, and better quality, mental health care. However, despite rapid spread of such technologies in high-income countries, they have not yet been commonly adopted in low-and middle-income countries. People living in these parts of the world are at risk of experiencing not only physical but also technological and social health inequalities. One possible solution is to utilise already available (and successfully implemented) HITs developed in other countries.

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Using participatory design methodologies with Colombian end users (young people, their supportive others, health professionals), this study aimed to: conduct co-design workshops to culturally adapt an online mental health clinic (MHeC) for young people; perform one-on-one user testing sessions to evaluate an alpha prototype of a Spanish version of the MHeC, and adapt it to the Colombian context; and, inform the development of a skeletal framework and alpha prototype for a Colombian version of the MHeC (MHeC-C).

### Methods

Utilisation of a research and development (R&D) cycle including four iterative phases: co-design workshops; knowledge translation; tailoring to language, culture and place (or context); rapid prototyping; and then, one-on-one user testing sessions.

### Results

Two co-design workshops were held with 18 users (young people n=7, health professionals n=11). A total of 10 participated in one-on-one user-testing sessions (young people n=5, supportive others n=2, health professionals n=3). 203 source documents were collected and 605 annotations were coded. A thematic analysis resulted in six main themes (i.e. opinions about the MHeC-C, Colombian context, functionality, content, user interface and technology platforms). Participants liked the idea of having a MHeC specially designed and adapted for Colombian young people and its five key elements were acceptable in this context (home page and triage system, self-report assessment, dashboard of results, booking and video visit system and personalized well-being plan). However, to be relevant in Colombia, participants stressed the need to develop some additional functionality (eg. phone network backup, chat, geolocation, and integration with electronic medical records, apps or e-tools) as well as adaptation of the self-report assessment. Importantly, the latter not only included language but also culture and context.

### Conclusions

The application of an iterative R&D cycle that also included processes for adaptation to Colombia (language, culture, context), resulted in the development of an evidence-based, language-appropriate, culturally-sensitive, context-adapted HIT that is relevant, applicable, engaging and usable in both the short- and longer-term. The resultant R&D cycle allowed for the adaptation of an already available HIT (i.e. MHeC) to the MHeC-C – a low-cost and scalable technology solution for low-and middle-income countries such as Colombia, which has the potential to provide young people with accessible, available, affordable and integrated mental health care at the right time.

**Keywords**

Colombia; telemedicine; medical informatics; eHealth; mental health; cultural characteristics; cultural competency; ethnic groups; quality of health care; community-based participatory research; primary health care; patient participation; patient preference; patient satisfaction; consumer health information; methods; research design.





## Introduction

### Background

According to the World Bank, Colombia (48 M inhabitants [1]) is defined as a low-to-middle income country (Gross Domestic Product (GDP) of US\$314 B [2]), however, its one of the most unequal countries in the world (with a 2017 GINI index of 49.7[3]). While the country has spent 7% of its GDP on health over the past 15 years [4], only 0.08% of that spending has gone to mental health – the lowest of all South American countries [5]. Furthermore, although the country has a high level of nationwide health coverage (95%) [6], this is still difficult to access for ethnic minorities and Colombia's poorest regions. This is particularly the case for rural regions, where 15% of the population lives [1]. As the Colombian health system is disease-centered, the continuity and the quality of care is jeopardized in these areas due to the difficulty of attracting qualified specialists [7]. In 2017, it was estimated that there were just 1,003 psychiatrists in Colombia [7] and that 80% of psychiatrists were situated within major cities, resulting in a treatment gap of more than 50% [8].

Colombia has a very young population (40% of the population is aged below 25 years and 18% of the population is aged between 15 and 24 years of age) [9]. According to the most recent Colombian National Mental Health Survey (NMHS) (2015), the lifetime prevalence rates of mental health disorders for adolescents aged 12 to 17 years was 7% (any disorder) and the rate of suicide attempts for this age group was 3% [8]. This survey grouped adults between 18 to 44 years of age, and hence the lifetime prevalence of these disorders in young adults is not clear. In a survey conducted in Medellin in 2012, the lifetime prevalence for young people aged 13 to 29 years of age were: depression 7%; any anxiety disorder 13% and post-traumatic stress disorder 4% [10]. However, there are only a small number of specialized child and adolescent psychiatrists in the country; most of them located in urban areas [11, 12]. Many Colombian adolescents access mental health services (outpatient and inpatient) through adult facilities, which may not be fully equipped to meet their unique needs (appropriate to the stage of illness and developmental period, youth-friendly, stigma-free, preventative, positive, flexible accessible, affordable, etc) which results in more alienation for this young population [13].

Given the nature of the Colombian health system and its geography, the Internet holds promise in bypassing barriers to accessing mental health care for the country's population. This is particularly the case as Colombia has universal Internet access (broadband, satellite or microwave) [14]. A recent information and communications technology use survey revealed that 64% of the households have access to the Internet and that 72% of the households have at least one smartphone. Further, there are more than 1,500 free WIFI hotspots located in major public places of the country. Colombia was one of the first countries in Latin America to propose a specific telehealth legislation (law 1419 of 2010). Its main aim is to integrate health information technology (HIT) interventions into the local health system in order to provide health services across all levels: promotion, prevention, diagnostic, treatment, rehabilitation and health education [15].

Telemedicine in Colombia has been successfully operating since 1998 [16]; today the country has more than 2,500 registered telemedicine service centers, which are located in the major cities and towns [17]. The number of these centers is constantly growing as some of the most important academic institutions and hospitals (public and private) are committed to delivering clinical assessments (including most of the medical specialties) to rural areas and marginalized populations [15, 17, 18]. The delivery of asynchronous telemedicine, which involves delivering end users text messages (more commonly containing questions) to experts (teleconsultation) has been postulated as an effective method for providing reliable health information and open dialogue about sensitive

topics such as sexuality, drug use or health concerns in the country [19-22]. Although HITs in Colombia seem to have a positive impact, most of the interventions still require rigorous evaluation [18].

However, while telemedicine has seen success in Colombia, there are a number of barriers to its further and more integrated implementation into the Colombian health system. There is still a certain degree of skepticism in the general population towards delivering their health care in this way, and health professionals still have limited knowledge on how to work effectively with technology [15, 23]. Notwithstanding the progress in the legislation, the current law still restricts the use of telemedicine in rural populations (therefore limiting its use in medium and small towns) and limits the use of telemedicine as a tool to only when face-to-face contact is not available [15, 16, 23]. Other legal limitations include the need for health professionals to be on both sides of the assessment (institution of remission and institution of reference), meaning that an individual cannot directly connect with local or international health professionals; and some concerns related to security, privacy, data sharing and data integrity [15, 23]. Innovative uses of HITs such as eHealth, mHealth and uHealth are still unregulated.

These barriers contribute to lack of uptake, engagement, and adherence, as well as high drop-out rates. These phenomena can be explained by Eysenbach's attrition law [24], which postulates that a substantial proportion of end users lose interest or experience some difficulties whilst using the technological intervention and will stop using it. This might be due to the perception that the intervention is not creating any benefit, that it is responding to an overly specific need, or that it has usability problems [24]. Although academia-led HITs have the strength of incorporating evidence-based and best clinical practices into their design, it is common to sacrifice the intervention's usability over content due to limited funding [12, 25]. For researchers, it is hard to compete with commercial products that provide highly intuitive and engaging experiences in their products, despite having unknown evidence-based or clinical value [12, 25].

In order to ensure that end users of HITs can derive maximum value from such interventions, it is critically important to involve them in their design and development, and to strike a balance between best clinical practice and user experience (including usability). Participatory design (PD) methodologies represent one such solution [26-28]. The process involves engaging end users and other stakeholders at all stages (from conception to completion) of the design, development and testing of these technologies [27],[29, 30]. Through several iterative phases the prototype is co-designed, co-developed and refined until it has value to the end users, meets their needs, and is appealing, engaging, acceptable and usable[31] [27, 32]. As end users share equal responsibility with the researchers for the outcomes, the rationale behind the use of PD methodologies could result in better products that are more functional in real-life settings, hence closing the translational research gap [27]. In recent years, it is more common to see the use of these methodologies in the development of mental health interventions in English-speaking countries [27-29, 31, 33]. However, to our knowledge these methodologies have yet to be used in Colombia, or any other Latin American country, in this field.

The University of Sydney's Brain and Mind Centre is a leader in development of evidence-based eHealth technologies [12, 27, 34-39]. Through a partnership with the Young and Well Cooperative Research Centre (2014-16) the prototypic version of the Mental Health eClinic (MHeC) [27, 37] was designed and developed. This web-based tool aimed to deliver best practice clinical services to people experiencing mental health problems making clinical care accessible, affordable and available to young people whenever and wherever they need it most. The original MHeC was then co-designed and culturally-adapted, developed and user tested (2015-17) with Spanish-speaking young people

currently living in Australia, resulting in the Spanish version of the Mental Health eClinic (MHeC-S) [32].

The original MHeC consisted of five key elements: a home page with a visible triage system for those requiring urgent help, a comprehensive online physical and mental health self-report assessment, a detailed dashboard of results (with colored icons and traffic light representations of results), a booking and videoconferencing system to enable video visits and the generation of a personalized well-being plan that includes links to evidence-based apps and e-tools recommended by health professionals and suggested by young people [27]. These elements were well accepted by Spanish-speaking young people living in Australia [32]. Considering the potential of the MHeC-S to be configured and adapted for use in Spanish-speaking countries and in other multicultural countries with Spanish-speaking migrant populations, as well as Colombia's health and Internet characteristics described above, we envisioned that a Colombian version of the MHeC (MHeC-C) could greatly benefit young Colombians who are actively seeking help.

### Aims

Using a modified version of our already established research and development cycle [27, 32] with Colombian end users (young people aged 16 to 30 years, supportive others and health professionals) as a framework, the aims of this study were to: (1) conduct co-design workshops with end users to culturally adapt the MHeC for young people in Colombia; (2) perform one-on-one user testing sessions with end users to evaluate the alpha prototype of the MHeC-S and how to adapt it to the Colombian context; and (3) inform the development of the skeletal framework and alpha prototype of the MHeC-C.

### Methods

#### Participants

Participants included community-based young people aged 16 to 30 years, health professionals and supportive others with regular access to a mobile phone (iPhone or Android) and the Internet. The recruitment strategy included the identification of potential participants through the reference groups and youth reference groups of our Colombian partner institutions (Pontificia Universidad Javeriana, Universidad de Antioquia and Universidad Autónoma de Bucaramanga), poster and postcard advertisements displayed in common areas where the reference groups meet, Facebook advertisements and a study-specific Facebook page.

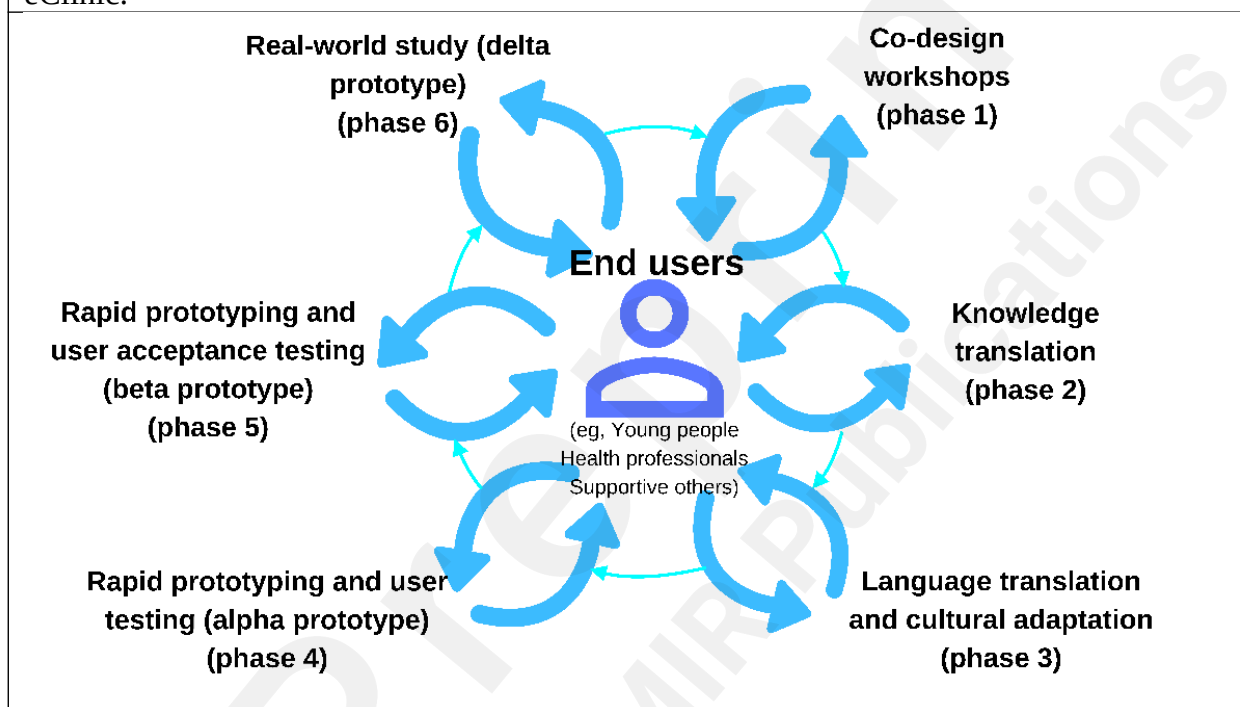
The University of Sydney's Human Research Ethics Committee approved this study (Protocol No. 2014/689 for the co-design workshops and Protocol No. 2016/487 for the user testing sessions); however, as requested by the HREC, local (Colombian) approvals were also obtained in order to ensure the study complied with all local regulations on research with humans. Participants were provided with the relevant information about the study (participant information statement) before consenting and participating in the study. Young people received gift vouchers to thank them for their time and expertise when they attended the co-design workshops and the user testing sessions.

#### Research and Development Cycle (R&D)

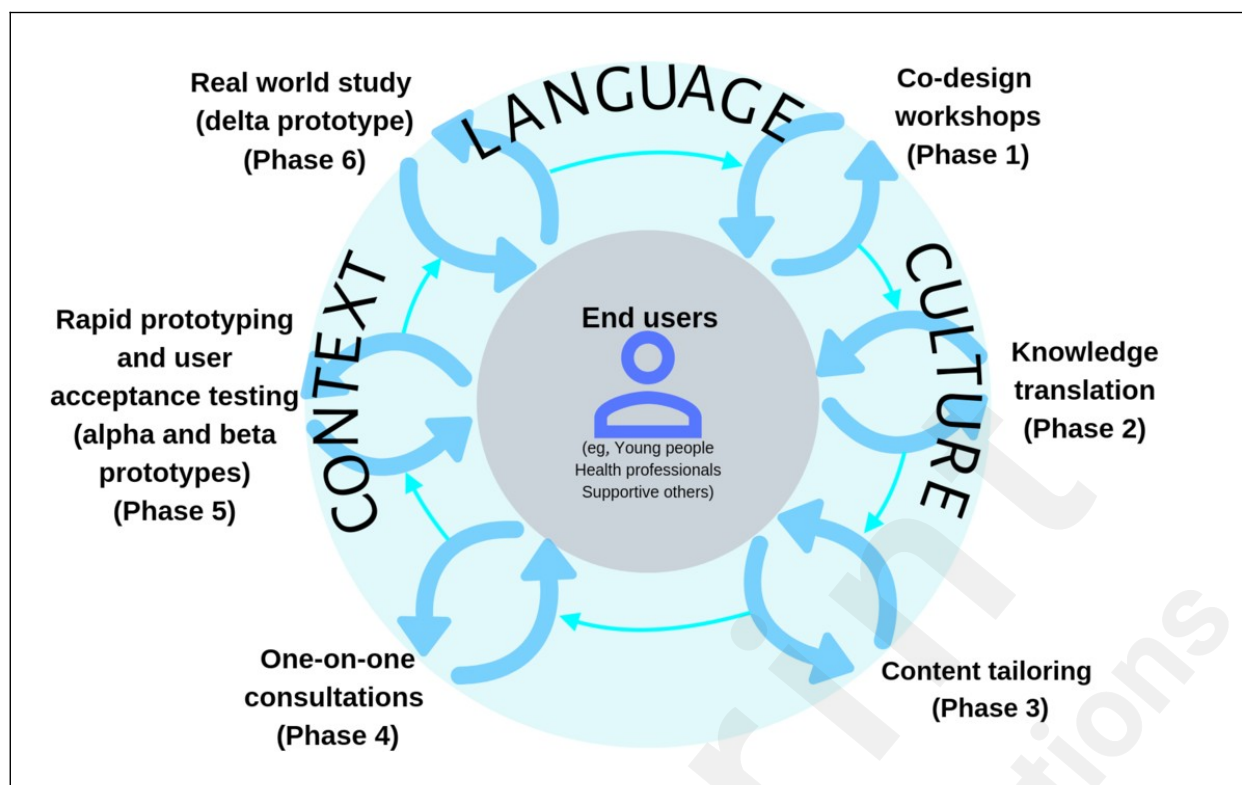
The PD methodologies employed in this study were based on the guidelines provided by the Young and Well Cooperative Research Centre [40] and were similar to the ones applied in our previous research [27, 31, 32]. The R&D cycle implemented in this study has been demonstrated to be an efficient method to obtain the most information from end users by engaging them in different activities. For this pilot study, we conducted a modified version of our previously established R&D

cycle (Figure 1) and (Figure 2) [27, 32]. This study consisted of four concurrently running phases: co-design workshops (Phase 1), knowledge translation (Phase 2), content tailoring (Phase 3) and one-on-one user testing sessions (Phase 4). Considering that language and culture are the key aspects in the process of adaptation, we decided to incorporate language and culture as part of the framework the R&D cycle based on. With that in mind, Phase 3 (Language translation and cultural adaptation) [32] of our previous MHeC-S's R&D cycle moved to be the cornerstone of the cycle used in this study, and Phase 3 in this study refers to the content tailoring process only. Phases 5: rapid prototyping and user testing (alpha [a preliminary version that can be interacted with for user testing purposes] and beta [a more refined version of the prototype that is much closer to the final product ] prototypes) and 6 (real-world study [with a delta prototype that can be used directly by end users for feasibility testing]) would be the subject of future research.

**Figure 1.** Previously established R&D cycle of the Spanish version of the Mental Health eClinic.



**Figure 2.** A language-appropriate, culturally-sensitive and contextually-adapted framework as an intrinsic part of the R&D cycle



### Phase 1: Co-design workshops

We held two co-design workshops, one with young people and the other one with health professionals. The workshops were conducted in Bogota, Colombia, in 2015. The aim of these workshops was to identify how best to co-design the MHeC-C's alpha prototype; and, more broadly, how to adapt the MHeC to a Colombian setting and population. The half-day (4 hour) workshops consisted of three stages: discovery; evaluation; and prototyping. At the end of each workshop the information was analyzed and synthesized by a knowledge translation team (consisting of two interns at The University of Sydney's Brain and Mind Centre) for design testing in subsequent workshops. Digital technology was not used in any stage of the workshops.

#### Discovery

Workshop moderators facilitated participant discussion in relation to the following topics: defining the advantages and disadvantages of having a MHeC-C, defining the barriers of having a MHeC-C and how a prototype like this should look and function in order to meet young persons' needs in the Colombian context. Handwritten notes were taken during the entire workshop.

#### Evaluation

Participants were then presented with screenshots of existing mental health websites and wireframes or mockups of the early versions of the MHeC and the MHeC-S for their critical evaluation. These items contained a variety of features of interest such as the five key elements of the MHeC and other relevant apps and e-tools related to mental health or well-being. Marker pens were provided for participants to annotate their observations.

#### Prototyping

Finally, participants were asked to hand-draw their ideas, specifications and requirements for a MHeC-C. Sketchbooks and marker pens were provided for this activity.

### Phase 2: Knowledge translation process

The knowledge translation process consisted of analyzing the visual artifacts (mockups and end user sketches) produced in the design testing and sketching stages and tallying requested MHeC-C features from the notes taken in Phase 1 (co-design workshops). Observations that were repeated three or more times were considered for inclusion in Phase 4 or in the development of wireframes. Discrepancies that arose during this process were discussed between the knowledge translation team and two mental health researchers and Colombian psychiatrists (LOP and ANM) until reaching consensus in the second session.

### Phase 3: Content tailoring

LOP and ANM reviewed the general content of the MHeC-S alpha prototype in order to detect language subtleties. A literature review of published (identified via PubMed, Google Scholar, SciELO, and LILACS) and gray literature (identified via Google Advanced search) was undertaken by LOP to identify relevant measures for this population, as well as those instruments already translated, validated and used in Colombia. Recognizing that some questionnaires might have several versions, the following process was established to select instruments: (1) selection of official and published translations; and (2) selection of published Colombian versions of the official translations. When more than one version or source was available, the two Colombian psychiatrists (LOP and ANM) selected the most appropriate to be included through discussion and consensus. If questionnaires were not publically available or there were no self-report versions for the topics to be assessed, expert recommendation (discussion and consensus between three Colombian psychiatrists LOP, ANM, and AC) was utilised.

### Phase 4: Remote one-on-one user testing sessions

Phase 4 involved in-depth one-on-one user testing sessions with new end users (young people, health professionals and supportive others). Sessions were held remotely using GoToMeeting and its shared screen capacity (GoToMeeting by LogMeIn, Boston, Massachusetts, United States, is a screen sharing software that allows users to display the entire screen, multiple monitors or specific applications at any time) [41] using laptops, tablets and mobile phones. In each 90-minute one-on-one user testing session, a researcher guided an end user into the already available alpha prototype of the MHeC-S. Using a think-aloud protocol [42] participants provided their observations as they were shown the navigation through the prototype. These sessions also explored the utility and the end users' inclination to use a MHeC in Colombia, overall comments, and naming of the prototype. Handwritten notes were taken during all sessions.

## Data analysis

All source documents (Phase 1 – co-design workshop notes and artifacts, Phase 4 – user testing notes) were uploaded to NVivo 11 for Mac (QSR International) and analyzed using thematic analysis techniques [43, 44]. Importantly, source documents were analyzed at the end of each phase in order to explore preliminary findings and inform subsequent phases. The thematic analysis framework involved both inductive and deductive coding, with the deductive codes being five previously identified themes [32]: help-seeking barriers; technology platform; functionality; content; and user interface [27]. Two Colombian psychiatrists (LOP and ANM) coded the material (LOP) and one researcher analyzed the information (LOP). Data collection and qualitative analysis were done in Spanish by LOP and ANM. To facilitate reporting of results, translated quotes from the source documents are included below and Multimedia Appendix 1 lists the original quotes in Spanish.



## Results

### Co-design workshops and user testing sessions

In June 2015, we conducted one half-day co-design workshop with young people in Colombia and one half-day co-design workshop with Colombian health professionals. In total, we conducted two knowledge translation sessions: one after the co-design workshops (Phase 1) and the other at the end of the one-on-one user testing sessions (Phase 4). We conducted 10 remote one-on-one user testing sessions in August 2017. The language and cultural adaptation process started in June 2015 and finished in November 2017.

### Participant characteristics

A total of seven young people participated in the co-design workshops; five were female and their ages ranged from 18 to 22 years (median age 19.5 years). A total of 11 health professionals participated in the workshops; five were female and their ages ranged from 20 to 29 years (median age 27 years). Of the health professionals, two were medical students and the rest were psychiatry registrars (Table 1).

A total of 10 participants participated in the one-on-one user testing sessions: five young people with ages ranging from 17 to 24 years (median age 22 years); three health professionals with ages ranging from 29 to 36 years (median age 29 years, all of them psychiatrists); and two supportive others with ages ranging from 19 to 24 years (median age 21.5 years). Of these participants, seven were female (Table 1).

**Table 1.** Participants characteristics

Characteristics	Co-design workshops with young people (n=7)	Co-design workshops with health professionals (n=11)	One-on-one user testing sessions (n=10)
<b>Demographics</b>			
Female, n (%)	5 (71)	5 (45)	7 (70)
Age in years, median (IQR) <sup>a</sup>	19.5 (3)	27 (2)	21.5 (8.5)
<b>Education</b>			
Secondary, n (%)	7 (100)	2 (18)	6 (60)
Tertiary, n (%)	0 (0)	9 (82)	4 (40)

### Coding framework

During the co-design workshops a total of 194 source documents were developed and analyzed (two sets of workshop notes and 192 artifacts produced by participants). A total of 312 annotations were coded: 106 annotations in the content theme, 151 annotations in the functionality theme and 47 in the user interface theme. Two new themes emerged in this phase: opinions about the MHeC-C (4 annotations) and Colombian context considerations (4 annotations). There were no annotations in the help-seeking or the technology platform themes in this stage.

During the one-on-one user testing sessions, 10 sets of notes were generated. A total of 293 annotations were coded: 132 annotations in the functionality theme, 58 in the user interface theme, 42 annotations in the content theme, 23 annotations in the opinions about the MHeC-C theme, 20 annotations in the Colombian context considerations theme and 18 annotations in the technology

platform theme. There were no annotations in the help-seeking theme, as a consequence it was removed from the coding framework analysis.

For the purposes of this paper, we report the data aggregated from the co-design workshops and the one-on-one user testing sessions, specifying in which session the information was collected where relevant.

### Opinions about the MHeC-C

All participants (28/28) liked the idea of having a MHeC specially designed and adapted for a Colombian context. As possible advantages they suggested it would reduce costs; even if initially the investment would be considerable, in the long-run individuals would save time and money and the need of physical infrastructure would be less. All young people (12/12), all health professionals (14/14), and supportive others (2/2) agreed a prototype like this would expand access to health professionals (especially in rural areas), facilitate monitoring and reduce loss to follow-up. This would ultimately increase satisfaction, convenience and engagement with the health system, as individuals would have more flexibility with their time and no location barriers. Additionally, all health professionals (14/14) felt the prototype would improve the health service network as it would provide specialized assessments regardless of the individuals' location and support for rural professionals. Integrating the MHeC-C with electronic medical records, laboratory results and pharmacological records would increase treatment adherence and provide more objective information that would translate in better monitoring and health outcomes. Some health professionals from the co-design workshops (7/11) also believed that this prototype could be safer in cases of assessing individuals with violent behaviours, whilst the rest (6/11) believe they would feel safer if the MHeC-C was part of the already established health network.

However, regarding disadvantages and barriers, all participants (28/28) mentioned that in some places the Internet connection is not reliable so the prototype needs to be backed up with a phone network. Among barriers of using a MHeC-C, all young people (12/12) mentioned difficulties accessing the Internet, as most young people don't pay for mobile data and therefore require Internet access in their homes, schools or free WIFI networks. All health professionals (14/14) recognized that the MHeC-C could have limited utility in acute cases or in cases where performing physical (neurological) assessments would be required.

### Colombian context considerations

Overall, health professionals (14/14) believed the MHeC-C should be led by a partnership between a university and a health service provider and have strong networks with the community and other relevant organisations. Partnership with local governments and stakeholders would be necessary but especially relevant in rural settings to increase trust and as a such, increase the acceptability of the prototype. In order for people to use the MHeC-C it needs to be recommended by clinicians, health services, and school and university well-being centres, which should be complemented with publicity and media coverage (e.g. radio, television, social networks, magazines, newspapers, etc). As most young people are not economically independent it would be important that the MHeC-C would be embedded in the public healthcare system.

In relation to the branding and name of the MHeC-C, young participants (12/12) considered that the combination of terms "mental health" and "clinic" would be less appealing for them as they might feel the MHeC-C deals only with severe cases and might not be appropriate for them and that it would, as a consequence, be more stigmatizing.



## Functionality

As defined by Valdez et al in their culturally-informed design framework [45], functionality indicates the actions that can be performed in the prototype. All participants (28/28) agreed that the five key elements of the MHeC-C were acceptable in this context. In general, participants agreed the MHeC-C should be compliant with international cybersecurity standards to ensure privacy and data protection.

### *Element 1: Home page and triage system*

All participants (28/28) agreed that in order to gain trust and increase credibility, the MHeC-C webpage's domain should be ".com", ".co", or ".org". Alternatively, the MHeC-C could be imbedded in universities' official websites, as they believe universities should have a lead role in the development and maintenance of this kind of prototype. Logos of the principal institutions as well as partner organisations should be displayed at this stage. Participants also agreed with providing a small description of the MHeC-C, delivered with images, videos and testimonials from young people and health professionals. Both young people and health professionals agreed the initial home page could be the same for both groups; however, after registration and logging in processes, the prototype would change in order to address both user types' different needs.

All participants liked the triage functionality and recognized the importance of referring someone to emergency help services promptly. In the same line, the 'Need Help Now' button was identified as an important resource for people in crisis that didn't know the emergency lines. Participants highlighted the importance of this button to be associated with a geolocation system, as in Colombia emergency (psychological) numbers change according to their location. As one health professional explained:

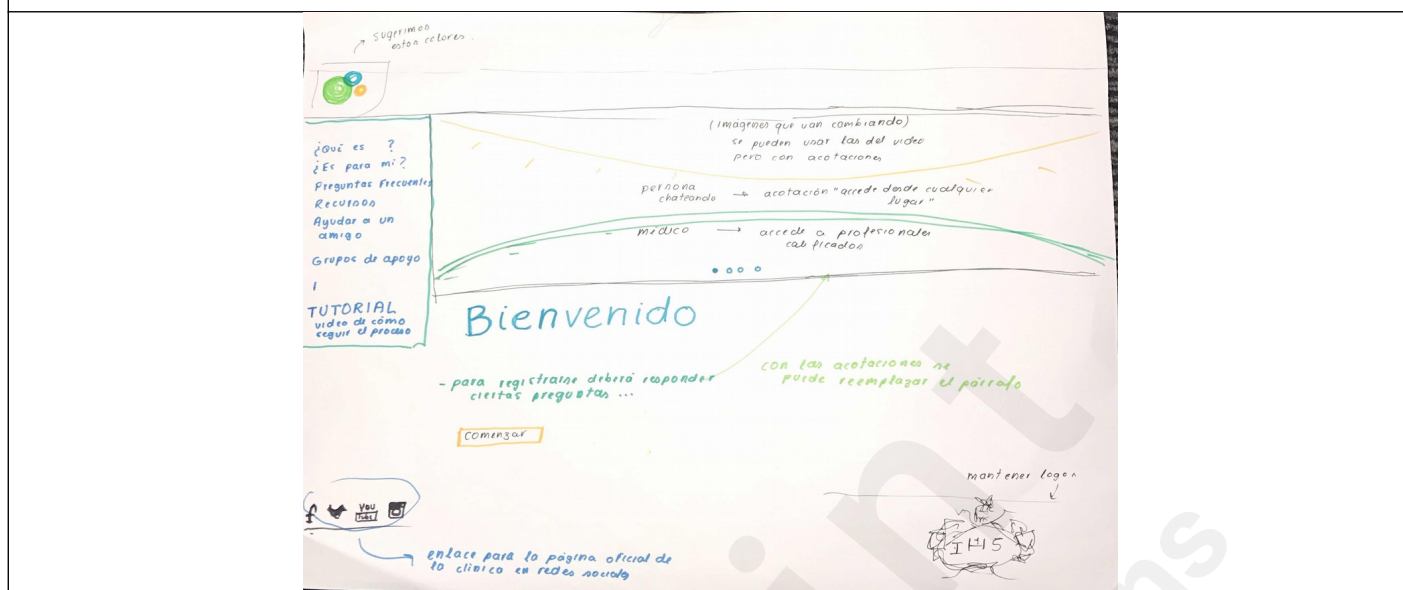
*"...the general emergency line is the same 123, but the psychological emergency line changes, for example in Bogota it is 106 and in Cartagena it is 125... [health professional, quote A]*

As online services are scarce in Colombia it was proposed to have an 24/7 moderated online chat that would provide support and counselling to individuals seeking help. For young people, this functionality would be situated under the 'Need Help Now' button. Health professionals believed a functionality like this would also be useful for them to provide guidance and supervision to other less experienced health professionals (e.g. general practitioners in their social compulsory service) or to those located in rural areas. The chat functionality for health professionals would work only for health services and professionals attached to the MHeC-C. In case the Internet connection is intermittent or lost, the chat functionality should also have a phone support service that would be enabled to continue with the conversation (Figure 3).

**Figure 3.** Hand-drawn sketch by end users during a PD workshop representing the chat functionality and the phone support service.



Participants acknowledged the difficulty of having health professionals available at all times to chat, so they proposed the chat to work only during extended hours (from 6 am to 12 am) and in off-time hours, have the possibility to leave a question to be answered later. At the same time, young people recognized the importance of having carefully moderated blogs, forums or group chats with a selection of helpful topics to find support and learn from other people's experiences. Figures 4 and 5 represent the proposed home page for future developments.

**Figure 4.** Hand-drawn sketch by end users during a PD workshop representing the home page**Figure 5.** Skeletal framework of the home page of the MHeC-C

### Element 2: Online physical and mental health self-report assessment

All participants agreed with the need to assess young people's physical and mental health. The already established features of this element were accepted among the end users: modular display of question sets, capacity of pausing and resuming later, and rule-based decision algorithms that enable personalized assessment of the young person. Again, participants mentioned the possibility of using geolocation in order to automatically collect data about the participants and personalize the assessment. As one health professional explained:

*"...it would be very useful to geolocate the person, this means the prototype would be able to know where they are so they don't have to waste time filling their addresses. Also, as Colombia is so diverse, we know that the regions have different needs so the questions could be specific to those needs. For example, in regions affected with violence, assessing this topic in-depth would be crucial. Another example would be assessing thoroughly the social*

*determinants of health if the person lives in a poor area or is identified with a low socioeconomic status... [Health professional, quote B]"*

The type of questions in the prototype (Likert-type scale questions and two-way closed-ended) were also acceptable to participants. However, health professionals (11/14) suggested adding visual responses such as the pain visual analogue scale [46] and including one open-text question with the aim of assessing the individuals's reason for accessing the MHeC-C over traditional face-to-face services.

### *Element 3: Dashboard of results and progress report*

There was a discrepancy in end users' opinion on the immediate display of the dashboard of results after completion of the online self-report assessment. All young people (12/12) and some of the health professionals (6/14) agreed the prototype should display the results immediately. Other health professionals (8/14) were concerned with the pertinence of the results as a young person could potentially experience some distress facing their results, especially for those living in rural areas. As a potential solution to this, participants suggested giving individual's the option to pick if they want to see their results immediately or wait to review their results with a health professional.

Participants agreed with the traffic light representations and colored icons. Simple bar and line graphs were preferred to represent progress and track data over time. Health professionals considered that the dashboard of results was useful to inform their practice, making the assessments more efficient and specific as well as enabling them to deliver interventions earlier and monitor the individual's progress over time. Additionally, health professionals believed that the results of the assessment and the dashboard were useful research tools. In relation to the dashboard's language, lay terms were preferred over medical terminology. The option of displaying a simple explanation of the term (only when medical terms are needed) when they click on the word or hover over it was widely accepted among the participants.

### *Element 4: Booking system and video visit*

Before booking a video visit, participants wanted to see the profiles of the health professionals attached to the MHeC-C so they could choose the professional they want to see. As a young person explained:

*"...I would like to know more who I'm going to see, so I can decide if I see a man or a woman or see what are their areas of expertise...[young person, quote C]"*

Additionally, it was proposed to have calendar functionality so young people could book appointments according to health professionals' availability. This functionality should also reflect other relevant calendars such as the health professional's calendar and the administrative staff so they can use it for other purposes such as billing.

Health professionals preferred that the video visit could also be a useful tool to provide supervision, training and consultation to colleagues located in rural areas. As a health professional explained:

*"...doctors in their social compulsory service (located in rural areas) might need support from specialists, it would be very useful to use the video visit system to help them assessing difficult cases or to provide supervision...[health professional, quote D]"*

Additionally, as some health services still have paper-based medical records, having an electronic medical record attached to the MHeC-C would be ideal so all individual's information would be stored in the same place.

Given that health professionals would have detailed and accurate self-report information before the video visit (dashboard of results) all participants agreed that around 20 minutes would be enough time to assess a young person and provide recommendations. Health professionals would also like the possibility to extend video visit time with complex cases. Should a video visit appointment run late, health professionals also suggested that the MHeC-C should send a notification to people waiting for subsequent appointments.

#### *Element 5: Personalized well-being plan includes links to evidence-based, young person-suggested and health professional-recommended apps and e-tools*

Participants accepted the activation of a personalized well-being plan and recommendations according to their results. Young people and health professionals believed these recommendations could be delivered as: apps, videos, or printable material. Health professionals suggested the MHeC-C to be connected to the website “mental punto de apoyo” (<https://www.javeriana.edu.co/mentalpuntodeapoyo/>)[47, 48] as this informational website has a wide variety of information, psychoeducational material and community blogs for individuals, carers and health professionals.

The shortage of Spanish-language apps and e-tools was also raised. Health professionals believed that developing such apps to track variables such as mood, sleep, physical activity and nutrition, as well as interventional apps that contain cognitive behavioral therapy strategies and mindfulness, would be necessary. In general, participants believed these apps and e-tools need to be in Spanish as the chances of using an English-based app are minimal. The need to create videos with general information, as well as relaxation and breathing exercises, was also mentioned.

## Content

### *General content*

Content refers to the message that is transmitted [45]. Participants from the one-on-one user testing sessions had the opportunity to explore the alpha prototype of the MHeC-S. These participants (10/10) found that some pieces of general content already available were relevant for them but needed minor tweaks to fit the context such as: general information about the MHeC-S, breathing exercises, frequently asked questions and how to help a friend. Other content including: health services information, terms and conditions and information about partner organisations needed major changes to be relevant to Colombia. Again, the scarcity of Spanish-language apps and e-tools was highlighted as they are the cornerstone of the personalized well-being plan.

### *Cultural adaptation of the self-report assessment*

The original Spanish-language self-report assessment included 20 modules (Table 2) with smart skips built in so that it was tailored to each individual and took the minimum possible amount of time to complete (approximately 45 minutes) [32]. Of the 20 modules, 19 modules were considered relevant by the participants and one module (cultural adaptation and adjustment disorder) was considered unnecessary. Health professionals (3/3) and supportive others (2/2) from the one-on-one user testing sessions suggested including further topics to be assessed. As ‘family’ is very important in Colombian culture, it was suggested to assess family structure and support network. Religion and spirituality were also considered important factors to be assessed as they might influence an individual’s mental health, act as support or define some treatments. Due to the country’s characteristics it was also considered necessary to evaluate social risk by screening economic stability, neighborhood and physical environment, food security and access to the healthcare system [49]. As Colombia has been severely affected by violence, participants also suggested to evaluate



violence exposure, trauma and resilience.

The cultural adaptation of the self-report assessment started in November 2016, with the literature review. We found six questionnaires that could be integrated to the MHeC-C in order to address the already mentioned needs. In order to assess family structure and support network, we selected the family APGAR that has been widely used in Colombia [50, 51]. In order to assess social risk we selected items assessing socioeconomic status, food insecurity, sanitation, access to drinking water, electricity, housing, assets and healthcare from the National Mental Health Survey (NMHS, 2015) [51]. Items regarding attitudes and experiences to violence (domestic violence, organized crime, displacement and armed conflict) from the NMHS were also included. Selected items from the Adverse Childhood Experiences questionnaire were selected to enrich the trauma component [52]. In relation to resilience we found three scales validated in the Colombian context –Adolescent Resilience Scale [53], Child and Youth Resilience Measure 12-item [54], and Connor-Davidson Resilience Scale (CD-RISC 10) [55]. All of these scales assess resilience's internal resources [56], however, the last two assess external resources as well. We selected the CD-RISC 10 as it has been widely used in the country and for its length. Religion and spirituality were also assessed with selected items from the NMHS. Table 2 represents the proposed self-report assessment for the MHeC-C.

**Table 2** Self-report assessments in each the MHeC-S and the MHeC-C

Self-report assessments of the MHeC-S <sup>a</sup>		Self-report assessments of the MHeC-C <sup>b</sup>	
Module	Questionnaires	Module	Questionnaires
1. Main reason for visiting the MHeC-S		1. Main reason for visiting the MHeC-C	
	Short open-text question		Short open-text question
2. General demographics		2. General demographics	
	Items adapted to Spanish from the Second Australian Young and Well National Survey [57] and the two-step method to measure transgender identity [58].		Items adapted to Spanish from the Second Australian Young and Well National Survey [57] and the two-step method to measure transgender identity [58]. Religion, spirituality socioeconomical status, food insecurity, sanitation, access to drinking water, electricity, housing, assets and healthcare selected items from the NMHS [51].
3. Social and occupational function		3. Social and occupational function	
	World Health Organization Disability Assessment Schedule 2.0 [59], and an adapted version of the self-report version of the Social and Occupational Functioning Assessment Scale [60].		World Health Organization Disability Assessment Schedule 2.0 [59], and an adapted version of the self-report version of the Social and Occupational Functioning Assessment Scale [60].
4. Psychological distress		4. Psychological distress	
	10-item Kessler Psychological Distress Scale [61].		10-item Kessler Psychological Distress Scale [61].
5. Depressed mood		5. Depressed mood	
	Quick Inventory of Depressive Symptomatology (QIDS-SR-16) [62, 63].		Quick Inventory of Depressive Symptomatology (QIDS-SR-16) [62, 63].

6.	Anxiety	Generalized Anxiety Disorder Assessment (GAD-7) [64].	6.	Anxiety	Generalized Anxiety Disorder Assessment (GAD-7) [64].
7.	Mania-like experiences	Items derived from the Altman Self-Rating Mania Scale [65].	7.	Mania-like experiences	Items derived from the Altman Self-Rating Mania Scale [65].
8.	Psychosis-like experiences	Items derived from the Community Assessment of Psychic Experiences-Positive Symptoms Scale [66, 67].	8.	Psychosis-like experiences	Items derived from the Community Assessment of Psychic Experiences-Positive Symptoms Scale [66, 67].
9.	Traumatic experiences	Primary Care PTSD <sup>c</sup> Screen [68] and the PTSD Checklist-Civilian Version [69].	9.	Violence exposure and traumatic experiences	Attitudes and experiences to violence (domestic violence, organized crime, displacement and armed conflict) from the NMHS. Selected items from the Adverse Childhood Experiences [52]. Primary Care PTSD <sup>c</sup> Screen [68] and the PTSD Checklist-Civilian Version [69].
10.	Self-harm behaviors and suicidal ideation	Suicide Behaviors Questionnaire-Revised (SBQ-R) [70].	10.	Self-harm behaviors and suicidal ideation	Suicide Behaviors Questionnaire-Revised (SBQ-R) [70].
11.	Tobacco, alcohol, and substance use	Items adapted from Alcohol Use Disorders	11.	Tobacco, alcohol, and substance use	Items adapted from the Alcohol Use Disorders



		Identification Test [71]; Alcohol, Smoking and Substance Involvement Screening Test [72]; and Cutting down, Annoyance by criticism, Guilty feeling, and Eye-openers questionnaire [73]. Items adapted to Spanish from the Drinking Motives Questionnaire [74], Fagerström Test for Nicotine Dependence [75], and selected items adapted to Spanish from the National Drug Strategy Household Survey [76].			Identification Test [71]; Alcohol, Smoking and Substance Involvement Screening Test [72], and Cutting down, Annoyance by criticism, Guilty feeling, and Eye-openers questionnaire [73]. Items adapted to Spanish from the Drinking Motives Questionnaire [74], Fagerström Test for Nicotine Dependence [75], and selected items adapted to Spanish from the National Drug Strategy Household Survey [76].
12.	Physical activity		12.	Physical activity	
		International Physical Activity Questionnaire [77, 78].			International Physical Activity Questionnaire [77, 78].
13.	Sleep behaviors		13.	Sleep behaviors	
		Sleep-related items from the QIDS-SR-16.			Sleep-related items from the QIDS-SR-16.
14.	General mental health conditions		14.	General mental health conditions	
		Spanish version of the World Mental Health Composite International Diagnostic Interview used in the National Comorbidity Survey Replication Adolescent Supplement [79, 80].			Spanish version of the World Mental Health Composite International Diagnostic Interview used in the National Comorbidity Survey Replication Adolescent Supplement [79, 80].
15.	Overall health and somatic distress		15.	Overall health and somatic distress	
		Items adapted to Spanish from the Somatic and Psychological Health Report [81], self-perceived health status, and general body measurements.			Items adapted to Spanish from the Somatic and Psychological Health Report [81], self-perceived health status, and general body measurements.
16.	Medical, mental health, and family history		16.	Medical, mental health, and family history	
		Multiple-choice questions			Multiple-choice questions
17.	Cognitive		17.	Cognitive	

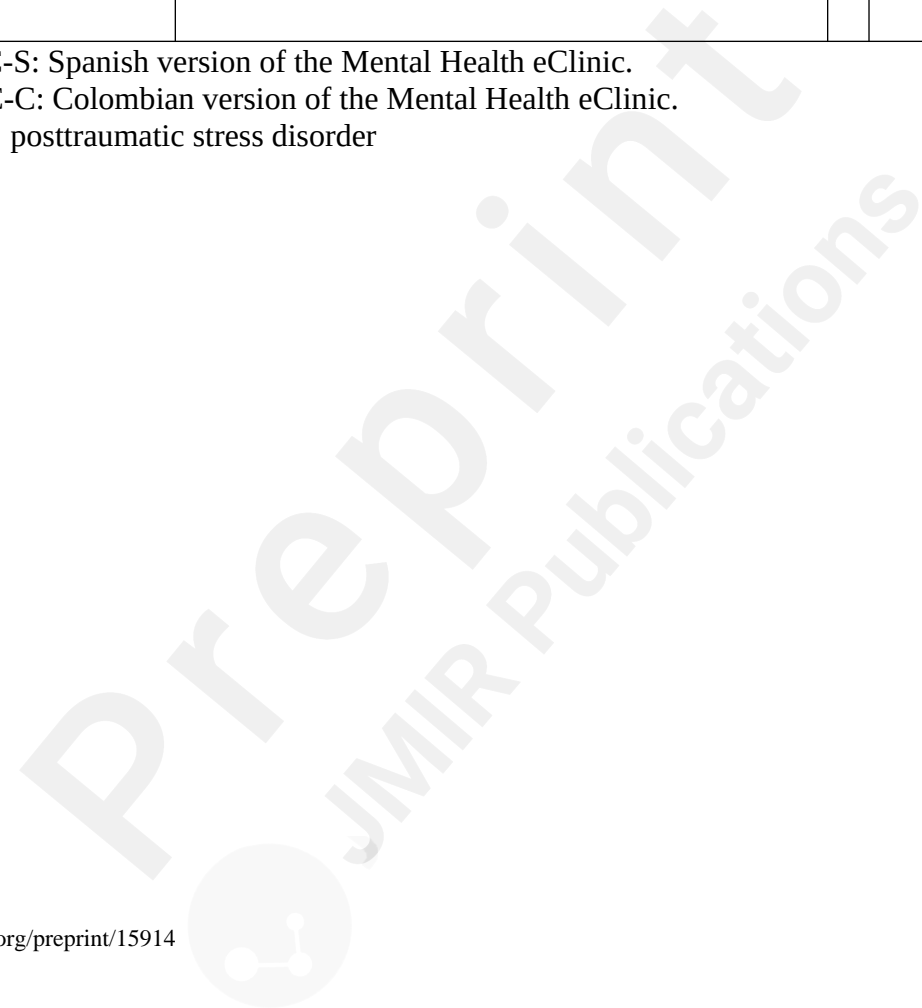
	concerns and empathy		concerns and empathy	
		Items derived from the Subjective Scale to Investigate Cognition in Schizophrenia [82] adapted to Spanish and the empathy quotient [83].		Items derived from the Subjective Scale to Investigate Cognition in Schizophrenia [82] adapted to Spanish and the empathy quotient [83].
18.	Eating behaviors and body image		18.	Eating behaviors and body image
		Items derived from the Eating Disorder Examination [84] adapted to Spanish.		Items derived from the Eating Disorder Examination [84] adapted to Spanish.
19.	Social connectedness and support		19.	Social connectedness, support and family structure
		Items derived from the Perceived Social Support/Conflict Measure [85] plus five items measuring relationships with peers [86] adapted to Spanish.		Items derived from the Perceived Social Support/Conflict Measure [85] plus five items measuring relationships with peers [86] adapted to Spanish and family APGAR [50, 51].
20.	Cultural adaptation and adjustment disorder		20.	Resilience
		Adaptation Scale (BSAS), Brief Psychological Adaptation Scale (BPAS), Brief Perceived Cultural Distance Scale (BPCDS), and Brief Acculturation Orientation Scale (BAOS) [87].		Connor-Davidson Resilience Scale (CD-RISC 10) [55]
			21.	Cultural adaptation and adjustment disorder (Optional,

			Consider in case of migrant populations)	
				Adaptation Scale (BSAS), the Brief Psychological, Adaptation Scale (BPAS), the Brief Perceived Cultural Distance Scale (BPCDS) and the Brief Acculturation Orientation Scale (BAOS) [87]

<sup>a</sup>MHeC-S: Spanish version of the Mental Health eClinic.

<sup>b</sup>MHeC-C: Colombian version of the Mental Health eClinic.

<sup>c</sup>PTSD: posttraumatic stress disorder





### User interface

User interface refers to the visual presentation of content and functionality [45]. When shown the homepage, participants agreed that the website should look professional but also be appealing and engaging for a young person. Horizontal menus were preferred over vertical menus in a laptop interface, but hamburger and vertical menus were the preference in tablets or mobiles. Young people (12/12) preferred to have less text and more visual content. Health professionals (14/14) and supportive others (2/2) also recognized the importance of visual content as they believed young people tend to read just the minimum amount of text and that information could be lost. Participants preferred to have on the home page pictures of young people interacting with the MHeC-C with a light background or calming landscape.

The colour palette suggested in the co-design workshops was blue-greens complemented with yellow-oranges. However, participants from the one-on-one user testing sessions liked the orange colour. The MHeC-S logo was rejected by participants in the one-on-one user testing sessions as they did not find any representation of mental health on it and did not find the colour appealing. Most participants (24/28) suggested a logo depicting a brain or a head (Figure 6):

*“...It reminds me of orange uniforms of the Colombian Civil Defense... [young person, quote E]”*

*“...I might be wrong but the logo needed to include a brain or a head or something like that... [health professional, quote F]”*

**Figure 6.** Hand-drawn sketch by end users during a PD workshop representing the MHeC-C's logo



Participants felt that the ‘Need Help Now’ button needed to draw individuals’ attention, and suggested making this button bigger or brighter and perhaps adding an icon that represented help such as a ringing phone, a Christian cross or a SOS acronym. Participants also felt that ‘Need Help Now’ should provide chat functionality as well as information about local emergency phone lines.

In relation to the interface’s language (regarding formal and informal pronoun usage), all end user groups agreed that the preference to use a particular pronoun was not an issue; however, they highlighted the importance of using the pronouns consistently. As a health professional explained:

*“...the country is so diverse that there are regions that use formal pronouns and others informal pronouns, the most important thing is to use it consistently... [health professional, quote G]”*

*professional, quote G]”*

As a possible solution to reconcile this discrepancy it was proposed that the prototype used the colloquial or familiar form of the second person singular pronoun (tú) as it was targeting young people.

### Technology platform

Technology platform refers to the different types of hardware [45] the prototype should work on. Unanimously, participants agreed that mobile phones were the most important device to increase the reach of young people. However, health professionals also suggested it should work on desktops, laptops and tablets – which are their preferred devices in the workplace.

## Discussion

### Principal findings

This pilot study used a modified version of our previously established R&D cycle to co-design and culturally-adapt a prototypic Spanish-language version of a Web-based mental health clinic (MHeC-S) into a Colombian version for young people in Colombia (MHeC-C). Thematic analysis resulted in adequate acceptability of the functionality of the five key elements of the prototype (a home page and triage system; a comprehensive online physical and mental health self-report assessment; a dashboard of results and progress report; a booking and videoconferencing system to enable video visits; and the generation of a personalized well-being plan that includes links to evidence-based, young person-suggested, health professional-recommended apps and e-tools). However, in order for these elements to be relevant in Colombia, participants stress the need to develop additional functionalities such as backing up the system with a phone network, a chat system, a geolocation system, and wide integration with electronic medical records and other already available apps and e-tools. Participants stated that in order to make the MHeC-C appropriate to the (Colombian) context, it needed to operate in alliance with academic institutions, health providers (at all levels) and other community organizations. Due to the unique Colombian context, the self-report assessment needed to include items evaluating (including the creation of specific algorithms) the social determinants of health, attitudes towards and experiences of violence, resilience and extending the trauma module to assess childhood adverse experiences. In relation to the future build of the MHeC-C, it needed to include refinements to the interface such as: changing the color palette, designing a logo that makes reference to mental health, and further modifications in language.

While the MHeC-S was comprehensible to our Colombian participants, many changes were requested. In agreement with other authors [88] we strongly advocate for the need to adapt HITs beyond language by considering cultural variations. The same authors suggest adapting or designing HITs to acknowledge cultural differences in four main dimensions: content, functionality, technology platform and user interface [45]. However, the methodology needed to achieve this has not been conceptualized. Continuing with our previous research [32], we aimed to adapt our prototype using a modified version of our previously established research and development approach[31] within a framework composed of two dimensions (language and culture). During this study a new theme emerged which added the missing piece of the methodology, the contextual adaptation. As a result, it was possible to obtain culturally and contextually appropriate information about what is required in terms of content and functionality, as well as preferences for the prototype’s interface and the technology platform.

All of this was done in a participative, collaborative and time-efficient manner. The approach enabled us to collect information, define the needs and find solutions on how the MHeC-C would respond to them.

In order to make these HITs available in other languages, cultures and places, it is necessary to tailor them beyond just language. In other words, it is important to consider them within a culturally and contextually appropriate framework. This framework should also incorporate the use of participatory design methodologies that involve stakeholders and end users from the beginning in the co-design, development and adaptation of these HITs (Figure 2). To our knowledge, this paper reports the first body of research that proposes a methodology researchers can replicate and use to adapt HITs. A systematic use of such methodologies would finally result in the development of evidence-based, culturally-sensitive, contextually-adapted HITs that are relevant, appropriate, engaging and usable in the short- and longer-term.

Data shows that people living in rural areas receive less mental health treatment than those residing in metropolitan areas [89]. As almost one quarter of the Colombian population lives in rural areas, the systematic adaptation process used in this study allowed us to thoroughly identify the potential specific requirements for rural populations such as the chat functionality to support local general practitioners (including those health professionals completing their social compulsory service), a geolocation system that will help tailor helplines and services available around them and necessary adaptations of the content of the MHeC-C's self-report assessment to reflect rural needs. Despite the proposed benefit, it is important to consider the barriers and challenges to implement the MHeC-C in real settings. Mental health and digital literacy levels are common obstacles in the implementation of HITs; it is well known that many people around the globe are unable to recognize mental disorders [90, 91] and that this lack of knowledge associated with stigma could prevent people from seeking help and providing treatment to those in need. These problems are a particular concern in low-and middle-income countries where health services are already limited [92].

Health professionals in our study showed some degree of apprehensiveness in relation to the aptitudes required for, and the pertinence of, an automatic display of the dashboard of results for young people. Paternalistic attitudes are no longer desirable as they increase the asymmetry in the relationship and finally lead individuals to agree with the health professional's decisions [93, 94]. The patient-centred approach and shared-decision making encouraged by the MHeC-C gives individuals more control and promotes mutual participation; and, research has shown that this type of care translates to better health outcomes and a more efficient health system [95, 96]. Increasing the individuals' power, strengthening critical thinking and empowering more informed and autonomous decisions are key concepts in HITs as they act as digital companions by providing individuals greater participation in the decision making process [97]. HITs also assist health professionals in presenting their advice in a respectful manner that includes the individual's singularity and complexity [98]. The proposed elements (dashboard of results and personalised well-being plan) of the MHeC-C could enhance young people's understanding of their health status, assist them in the decision making process, build their sense of agency and promote their functional empowerment.

Another challenge would be the integration of the MHeC-C with the current Colombian health system and benefit schedule which is under the administration of several public and

private institutions (that use regulated government funds) [99]. As there are many institutions involved in provision of services, the MHeC-C would need to integrate with all of them in order to avoid perpetuating health inequities. The final goal of developing HITs is to actually develop a prototype that has great value for all end users even if the set of functionalities are different. For example, while a young person would use the MHeC-C to improve their health and wellbeing, track their progress, and stay connected to their health professionals, health professionals would use the system to inform their day-to-day practice, access support and training, and facilitate communication with those under their care. By building an appealing, usable prototype that responds to these specific needs based on end user type, we aim to surpass the attrition law and sustain usage over time.

Our strategic partnerships made it possible for a native Colombian team of researchers to conduct all the phases (including data collection and analysis) in the Spanish language. This approach reduced the risk of losing information (or meaning), and increased research efficiency by decreasing time and costs [100]. Additionally, through working closely with end users, the adapted R&D cycle allowed constant iteration of the MHeC-C in response to technological advances and end user needs. Effective engagement with local stakeholders, the use of local capacities and systems, and measuring relevant results for the community have been identified as strategies to promote translational research in low-and middle-income countries [101].

### Implications

Countries like Colombia, which have limited resources allocated to health (7% of its GDP), struggle to make decisions regarding where to invest in order to have the best outcomes. HITs show promise in reducing costs and being cost-efficient in the long-run [102, 103]; however, the development (from conception to implementation and sustainability) is an expensive and arduous process [104, 105]. At the same time, building up capacity by training health professionals and increasing infrastructure is also a slow and pricey pathway [106-108]. As a solution, we proposed a rigorous methodology to adapt already available (and evidence-based) HITs along three main pillars: language, culture and context. A systematic use of this approach has the potential to reduce costs and to increase the number of HITs available (in different languages and cultures) in a time-efficient manner. HITs that show value in terms of content and appropriateness to context could integrate with already available health systems and finally help to breach not only physical, but also technological and social health inequalities [109], making health care more accessible, affordable and available.

The Colombian context is complex as despite economic growth, it continues to be one of the most unequal countries in the world [110]. One quarter of its population live in rural settings with low numbers of health professionals, limited infrastructure [11], and high levels of violence following five decades of internal conflict. This results in a high level of challenge for individuals, health professionals, health providers and decision-makers to change the delivery model as well as treatment standards. Web-based solutions mark a paradigm shift beyond traditional models of health-care delivery. Integrating physical resources with HITs would capitalise on Colombia's heavy investment in telecommunications and could enable the Colombian population to access new resources, make better use of expertise and provide better access for individuals, peers and families. This should be done through collaborative interdisciplinary work with ongoing international support to capitalise on global medical knowledge and find new solutions, leading to quicker innovations in health service delivery.



### Limitations and future research

While the importance of adapting HITs appropriately to the local context cannot be overstated, it must also be acknowledged that contexts are in constant change. For example, Colombia's population makeup has changed since 2015 (when the workshops were conducted) due to recent migration from Venezuela. In the past year, more than 350,000 people have migrated from Venezuela [1], and at the beginning of 2019 it was calculated that there were more than 1 M Venezuelans residing in the country. Migrant populations have been identified to be at greater risk of psychological distress or common mental disorders, and host countries must respond to this effectively. A pressing future need of the MHeC-C would be to include migrant populations; therefore, a new cycle of adaptation would be required. As an initial proposal and capitalizing from our previous research [32] the new version of the MHeC-C would include the cultural-adaptation and adjustment disorder (available from the MHeC-S) items as the addition of the assessment of other risk factors such as: conditions of the migration process, level of acculturation, family reunification, perceived discrimination, and the length of time of the residence in the host country [111].

Another limitation was the relatively small sample size, although, this number still enabled us to collect sufficient information for analysis in the framework and reach saturation point. It is important to consider the large percentage of young people in Colombia and their diversity; as a consequence, these results cannot be extrapolated to the general population, and thus, further research is needed in tailoring the MHeC-C to rural and diverse populations. Additional research is also needed to develop the MHeC-C and test its engagement, efficacy, and effectiveness of the MHeC-C in real-world settings and engage other stakeholders such as administration/management, peers, NGOs, other community organizations and senior health professionals with diverse degrees of technology literacy.

### Conclusions

In low-and middle-income countries, the potential to utilise already developed HITS for improved access to, and better quality, mental health services is enormous. This would result in not only better mental health outcomes for young people but also more efficient, effective and appropriate use of scarce health professional knowledge and clinical skills, as well as quality improvements in mental health service delivery. Here, an adapted R&D cycle resulted in a technology solution acceptable for use by Colombian young people (and their supportive others) experiencing mental health problems as well as health professionals delivering care. This methodology should now be applied to other HITs as a means to bridge the digital and health care gaps not only in Colombia and the developing world; but also globally to other communities or settings where resources are scarce, culture matters and/or geography presents a challenge.

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## Conflicts of Interest

Professor Ian Hickie was an inaugural Commissioner on Australia's National Mental Health Commission (2012-18). He is the Co-Director, Health and Policy at the Brain and Mind Centre (BMC) University of Sydney. The BMC operates an early-intervention youth services at Camperdown under contract to headspace. Professor Hickie has previously led community-based and pharmaceutical industry-supported (Wyeth, Eli Lilly, Servier, Pfizer, AstraZeneca) projects focused on the identification and better management of anxiety and depression. He was a member of the Medical Advisory Panel for Medibank Private until October 2017, a Board Member of Psychosis Australia Trust and a member of Veterans Mental Health Clinical Reference group. He is the Chief Scientific Advisor to, and an equity shareholder in, Innowell. Innowell has been formed by the University of Sydney and PwC to deliver the \$30m Australian Government-funded 'Project Synergy'. Project Synergy is a three year program for the transformation of mental health services through the use of innovative technologies

## Abbreviations

GDP: Gross domestic product  
HIT: Health information technology  
KT: Knowledge translation  
MHeC: Mental Health eClinic  
MHeC-C: Colombia version of the Mental Health eClinic  
MHeC-S: Spanish version of the Mental Health eClinic  
NMHS: Colombian National Mental Health Survey  
PD: Participatory design  
PTSD: Posttraumatic stress disorder  
R&D: Research and development

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## Appendix 1

Quote A: *“...the general emergency line is the same 123, but the psychological emergency line changes, for example in Bogota it is 106 and in Cartagena it is 125...”*:

La línea general de emergencias es 123, pero las líneas de atención psicológica cambia por ejemplo en Bogotá es 106 pero en Cartagena es 125

Quote B: *“...it would be very useful to geolocate the person, this means the prototype would be able to know where they are so they don't have to waste time filling their addresses. Also, as Colombia is so diverse, we know that the regions have different needs so the questions could be specific to those needs. For example, in regions affected with violence, assessing this topic in-depth would be crucial. Another example would be assessing thoroughly the social determinants of health if the person lives in a poor area or is identified with a low socioeconomic status...”*:

Sería muy útil geolocalizar a la persona. Esto nos ayudaría a que el sistema supiera donde se encuentran y así los pacientes no tienen que perder tiempo llenando donde viven. Además, cómo vivimos en un país tan diverso en sus necesidades sería una buena idea que las preguntas reflejaran esto. Por ejemplo, en las regiones más afectadas por la violencia podríamos evaluar este tema en profundidad. Otro ejemplo sería en regiones más pobres o de bajo estrato socioeconómico valorar bien los determinantes de la salud...”

Quote C: *“...I would like to know more who I'm going to see, so I can decide if I see a man or a woman or see what are their areas of expertise...”*:

Me gustaría saber quien me va a atender, elegir entre un hombre o una mujer o saber quien es experto en las áreas que me interesan.

Quote D: *“...doctors in their social compulsory service (located in rural areas) might need support from specialists, it would be very useful to use the video visit system to help them assessing difficult cases or to provide supervision...”*:

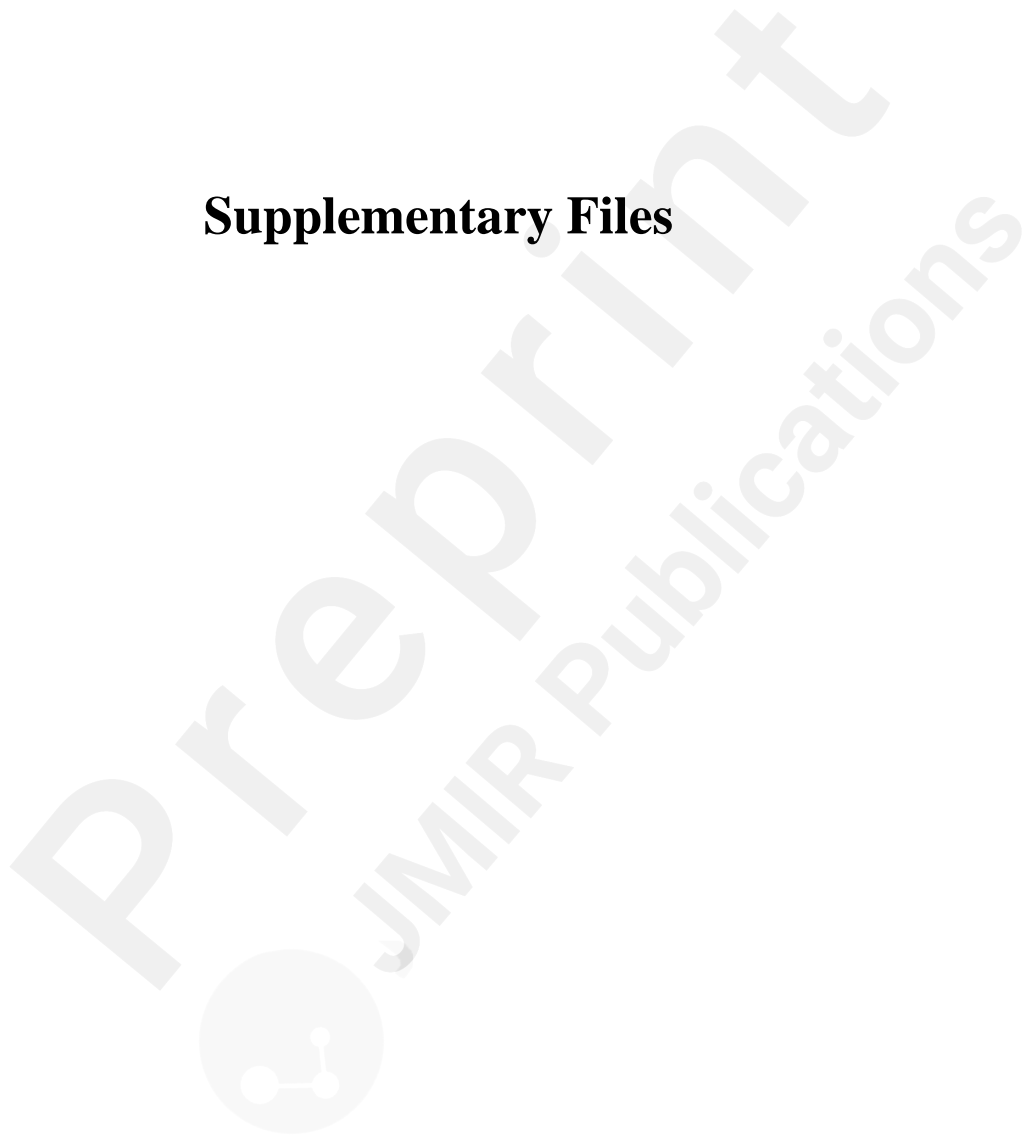
Los rurales pueden necesitar ayuda de los especialistas con los casos difíciles, el Sistema de videoconferencia sería útil en estos casos para ayudarles con las valoraciones o supervisarlos

Quote E: *“...It reminds me of orange uniforms of the Colombian Civil Defense...”*: Me hace pensar en los uniformes anaranjados de la Defensa Civil Colombiana

Quote F: *“...I might be wrong but the logo needed to include a brain or a head or something like that...”*: Puede que esté equivocado pero creo que el logo debería incluir un cerebro o una cabeza, algo así.

Quote G: *“the country is so diverse that there are regions that use formal pronouns and others informal pronouns, the most important thing is to use it consistently...”*: El país es tan diverso, que hay regiones que usan los pronombres formales y otras los informales, creo que lo más importante es ser consistente

## Supplementary Files



## Figures

