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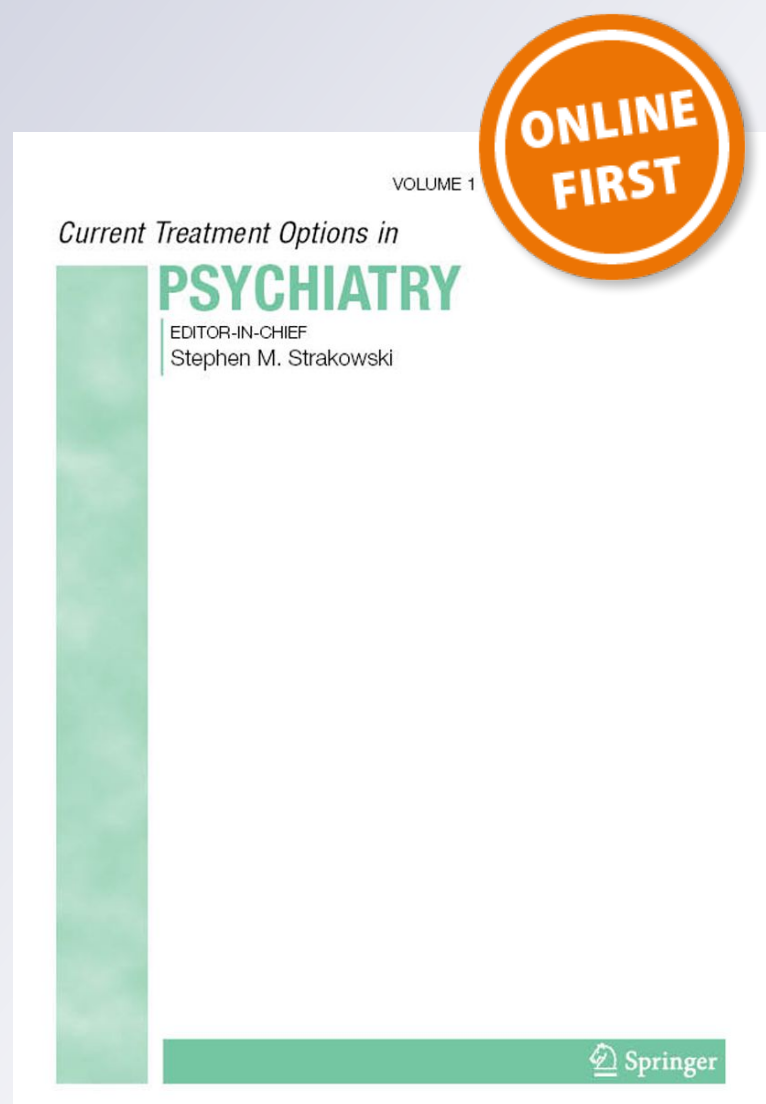
Use of Digital Mental Health for Marginalized and Underserved Populations

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Use of Digital Mental Health for Marginalized and Underserved Populations

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Abstract

Purpose of review Digital mental health (DMH) interventions provide opportunities to alleviate mental health disparities among marginalized populations by overcoming traditional barriers to care and putting quality mental health services in the palm of one's hand. While progress has been made towards realizing this goal, the potential for impactful change has yet to be realized. This paper reviews current examples of DMH interventions for certain marginalized and underserved groups, namely, ethnic and racial minorities including Latinx and African-Americans, rural populations, individuals experiencing homelessness, and sexual and gender minorities.

Recent findings Strengths and opportunities, along with the needs and considerations, of each group are discussed as they pertain to the development and dissemination of DMH interventions. Our review focuses on several DMH interventions that have been specifically designed for marginalized populations with a culturally sensitive approach along with other existing interventions that have been tailored to fit the needs of the target population. Overall, evidence is beginning to show promise for the feasibility and acceptability of DMH interventions for these groups, but large-scale efficacy testing and scaling potential are still lacking.

Summary These examples of how DMH can potentially positively impact marginalized populations should motivate developers, researchers, and practitioners to work collaboratively with stakeholders to deliver DMH interventions to these underserved populations in need.

Introduction

Technology is regularly touted for its promise to overcome health disparities, offering widely accessible, yet low-cost resources that can transcend time, place, and language. Technology, therefore, may play an especially important role in mental health services. Minorities are less likely to receive mental health services and when they do are more likely to receive lower quality care [1, 2]. As such, digital mental health (DMH) tools might be able to overcome several identified barriers to quality care among marginalized and underserved populations including access, cost, transportation, and stigma. DMH tools can be tailored for different groups by adjusting cultural and language aspects of DMH interventions that might increase their appeal and uptake.

At the same time, however, technology has yet to realize this potential. Health disparities still exist. The barriers associated with technology ownership and use may differ from those present in health care, and thus,

unique considerations might need to be taken into account for the development and deployment of digital tools. Such barriers include lack of access or different access to technology infrastructure including desktop computers, mobile phones, and high-speed and wireless Internet. For example, a recent study evaluating the use of mobile health apps among diverse patients illustrated challenges completing even the core functions of those apps [3]. As such, if marginalized and underserved populations are not considered during the development and evaluation of DMH, these technologies might serve to further entrench, rather than overcome, existing disparities.

The goals of this paper are to review the current examples of the use of DMH interventions for marginalized and underserved populations, to distill commonalities among this work, and to identify considerations and priorities for future development and research.

Defining marginalized and underserved populations

We draw our definition of marginalized and underserved populations from the National Institute of Minority Health and Health Disparities which focuses on producing equal opportunity for health for all populations [4]. This definition is broader than racial and ethnic minorities and includes underserved rural populations, those with fewer economic resources (e.g., individuals experiencing homelessness), and sexual and gender minorities [5]. These populations face discrimination and social disadvantages presenting challenges in many areas of their life including access to mental health care. In addition to being barriers to receiving care, discrimination and social disadvantages contribute to stress and the development of mental health issues [6]. We consider a few populations that fall under this broader definition as they provide good examples of the existing work on DMH interventions for marginalized and underserved populations. This include ethnic and racial minorities including Latinx and African-Americans, rural populations, individuals experiencing homelessness, and sexual and gender minorities.

Ethnic and racial minorities

In this section, we will discuss interventions that have been deployed for various racial and ethnic groups. Although work has investigated the use of DMH for a multitude of racial and ethnic groups, here we highlight work conducted in the USA within two groups specifically—Latinx and African-Americans, because the work in these groups illustrates key points that encompass strengths and issues involved in DMH deployment.

In the USA, Latinx individuals own smartphones at the same rates as whites (both 77%) [7]. This high ownership of smartphones among Latinx populations provides an opportunity for DMH interventions to be disseminated among this population that has historically underutilized traditional mental health services [8]. However, Latinxs are more likely to be “smartphone dependent” compared with Whites, that is to own smartphones but lack broadband Internet access at home [7]. In addition, they are more likely than other groups to interact via text messaging or mobile messaging platforms such as WhatsApp. Glimpses into their specific use of these devices, such as messaging platforms, might also speak to the forms and content of interventions that might be relevant.

Despite low utilization of standard services, there appears to be an interest in digital health among the Latinx population. In a survey of primary care Latinx patients, 86% stated an interest in utilizing a health app and 40% expressed motivation to use such apps daily [9]. Latinx smartphone users also report being 20% more likely than whites to use a health app [10]. However, many studies of digital health interventions do not include or have low rates of Latinx/Hispanic participants. While there is more to be done, some researchers have begun to target Latinx populations in their DMH interventions.

Digital and mobile health apps targeting Latinx populations have often targeted depression [11, 12, 13••], among other mental health concerns such as alcohol abuse [14] and disordered eating [15]. In a fully remote mobile app intervention for depression, Latinxs responded equally well to the intervention but dropped out earlier on average [13••]. In targeting this population, it is important to incorporate culturally relevant themes. One example of cultural differences within digital health experience is a finding that Spanish-speaking Latinxs focused on the role of interventions in helping them feel cared for and supported, while English speakers (which included one Latina, but the rest white or African-American) emphasized the introspective and self-reflective nature of the depression intervention [16]. Thus, tailoring DMH interventions to focus on the provision of support and care may be particularly apt for targeting Latinx populations.

While cultural tailoring and adaptation takes more time and effort, particularly given the diversity of Latinx subgroups, one straightforward improvement in this field would be to offer existing mental health apps in Spanish (and other languages). Aguilera et al. [11] found that using automated text messaging as an adjunct to group cognitive behavioral therapy (CBT) for depression in Spanish resulted in significantly increased engagement, as evidenced by patients attending more sessions and staying in treatment longer. These studies have all reported generally positive qualitative feedback regarding the use of technologies to support therapeutic interactions. While translation does not always ensure cultural relevance, it is an initial step in widening access to digital mental health tools. Overall, researchers and developers have not taken enough advantage of developing digital health interventions for this engaged and high need group.

The combination of substantial African-American health disparities coupled with their high rate of smartphone ownership should situate them as an ideal population for DMH interventions. Similarly to Latinxs, African-Americans own smartphones at similar rates to whites (75% vs. 77%) but are much more likely to be smartphone dependent. Far fewer studies, however, have focused

specifically on DMH interventions for African-American populations, and the potential to expand access for African-Americans through technologies has not been realized. One impediment is the extremely low rate of African-American recruitment in mobile health intervention studies [17]. For the most part, researchers are not going beyond the one-size-fits-all approach for designing DMH interventions and recruiting African-Americans into their studies. This lack of involvement is compounded by the fact that to our knowledge, there are no DMH interventions that have been specifically designed for African-American populations.

Although no DMH interventions have been specifically designed and evaluated for African-American populations, there are some examples of DMH interventions successfully aiding in mental health management for samples that are mainly comprised of African-American individuals. In each of these examples, the DMH intervention used an adjunct to standard treatment that was meant to enhance the available options for therapeutic benefits. In one small study, a telemedicine intervention aimed at managing PTSD symptoms for combat veterans helped to reduce symptoms and was rated as preferable than face-to-face therapy [18]. In another illustration of DMH being utilized by a primary African-American population, a digital biofeedback tool was used to help women veterans reduce depression symptoms associated with trauma [19]. Finally, a more comprehensive and multimodal intervention called FOCUS produced significant and sustained reductions in depression for a majority African-American sample of participants [20]. These examples demonstrate that DMH interventions have the potential to help African-Americans with mental health issues. However, the lack of culturally appropriate tailoring, stakeholder input, and effective recruiting efforts limits the effectiveness of these interventions for alleviating health disparities for this population. To better serve the African-American population, more attention should be paid to their unique needs and DMH interventions should be better designed and disseminated with those needs in mind.

Rural populations

Mental health services are overrepresented in urban areas, making it challenging to receive appropriate and effective services in rural areas. Indeed, the population is similarly skewed with 80% of the population living in 3% of the US land mass, which presents additional challenges with reaching the remaining 20% of the US population [21]. Telephones and video conferencing software have been used for years to connect those in need in these rural areas to providers from other areas [22]. These technologies allow for synchronous communication between a provider and client and help overcome barriers of geography and transportation. However, such technologies still require providers who are available with expertise in the issues that might arise in rural populations. In light of this, a few DMH interventions have been developed and evaluated with an eye towards expanding effective treatment options in rural settings.

Unlike racial and ethnic minorities, technology access is much lower in rural populations. For example, smartphone ownership is only 65% compared with

83% in urban populations and broadband internet access is much lower as only 61% of people in rural areas can get access to broadband internet compared with 96% in urban areas [23]. Therefore, although DMH interventions in rural populations address a clear need, there remain infrastructural issues to overcome to ensure that such interventions can be useful. Therefore, the type of technology utilized may be an important concern in rural populations. DMH interventions in rural populations might require preferencing more established and available technologies that have less intensive data demands.

Early work in rural settings has mostly focused on understanding the feasibility and acceptability of DMH interventions. As such, this work tends to use small samples and evaluate metrics of engagement and satisfaction. For example, one study explored Text4Strength, an interactive text messaging intervention designed for students in rural communities [24]. Most students (91%) engaged with at least one interaction, but that percentage dropped considerably (52%) when examining those who engaged in at least three interactions. Nevertheless, over 70% of the students found this intervention helpful. Another series of studies described the development and early evaluation of the SPIRIT app, a mobile health system to facilitate a collaborative care treatment model for patients with post-traumatic stress or bipolar disorders [25, 26••]. Similar to Text4Strength, this app was evaluated with a small group of individuals but showed some early promise with high rates of usability and engagement. Another output stemming from Bauer and colleagues [25] work in developing the SPIRIT app was the discovery of unique principles of development that should be considered when designing mental health technologies. These principles extended nine previous principles for digital development with five additional principles: (1) design for public health impact, (2) add value for all users, (3) test the product and the process, (4) acknowledge disruption, and (5) anticipate variability. These five additional principles align with other work that has expanded participatory design and research principles for underserved populations [e.g., 27]. As such, it is worth noting that although developing DMH interventions should follow methodologies from broader technology development, it requires a consideration of principles that might be unique to the space. Overall, it seems that despite some additional considerations, such as technology infrastructure, that must be addressed in these settings, DMH holds promise for rural populations. More work needs to explore the scalability of such interventions and whether scaling identifies additional challenges that need to be overcome.

Individuals experiencing homelessness

Technology access among individuals experiencing homelessness is not as low as some might believe. Data from adults experiencing homeless suggest that most own mobile phones (93%) and many own smartphones (58%) [28]. Youth and young adults experiencing homelessness have even higher rates of smartphone ownership, sometimes even as high as their housed peers [29, 30••]. However, individuals experiencing homelessness face other barriers to using technology including keeping consistent phones phone numbers and charging devices to keep them operational. They are also more likely to use

older and cheaper models. Other considerations exist as well, as 86% of adults experiencing homelessness were found to use Android devices [28], although use of Android devices in the USA among the general population is only slightly greater than half. Internet connectivity for individuals experiencing homelessness is an important way to maintain continuity and connection in their life and to seek housing and employment. As such, it may be a useful pathway to engage individuals experiencing homelessness in mental health services.

Indeed, some early work has started to examine DMH interventions oriented towards individuals experiencing homelessness. Homelessness often consists of a complex array of challenges, including housing and employment, which must be addressed when designing mental health services. An overview of this early work illustrates some key points in developing and deploying effective digital interventions for this population. First, technology can serve as an important bridge to accessing a wealth of resources. For example, the StreetConnect app provides a broad range of referral resources intended to address the various needs of those experiencing homelessness [31]. Second, for service providers working with individuals experiencing homelessness requires an appreciation of how to reach them physically and digitally. Common platforms, such as social media, might be a particularly effective way to stay connected, especially among youth populations, and can be an effective tool for introducing interventions [32]. Lastly, although early work has demonstrated that DMH interventions are liked and used, they have failed to establish clinical effectiveness [30••]. Further work should establish that not only do homeless populations like and use DMH intervention but that these interventions produce a beneficial impact on their lives. Similar to work in rural populations, DMH for individuals experiencing homelessness shows promise as technology appears to be a useful way to establish and maintain connections with this group. More work needs to determine, however, what goals technology is most effective at achieving, for example, connection to services, strengthened relationships, improved self-efficacy, and evaluating DMH interventions in light of those goals. Such constructs might be the precursors to changes in clinical symptoms. Additionally, when working with individuals experiencing homelessness, one also needs to consider broader factors that can promote better mental health such as housing, employment, and social support.

Sexual orientation—LGBTQ

Sexual and gender minorities are faced with a unique set of challenges (e.g., social ostracism) that can impact mental health [33]. LGBTQ individuals are significantly more likely to have depressive symptoms than their heterosexual counterparts but have difficulty accessing psychological services, likely due to the challenges of finding a therapist who can specifically address issues relevant to this population [34]. At the same time, rates of technology ownership among LGBTQ individuals are comparable with their heterosexual peers [35]. LGBTQ individuals are also very likely to seek support through digital means. At CrisisTextLine, a text message-based crisis support service, 44% of the people who text are LGBTQ [36] and gender and sexual identity issues account for 1.8% of the

Table 1. Summary of DMH considerations for each group

Group	Ownership and use	Strengths and opportunities	Needs and considerations
Latinx	77% own a smartphone, and 20% own a cellphone but not a smartphone [7].	Messaging platforms like WhatsApp show higher rates of adoption and use [51]. Potential for inclusions of social aspects, as feeling cared or supported [16].	Language considerations for Latinx population who is monolingual Spanish (or might prefer Spanish for some interactions). Higher prevalence of mobile-only Internet access.
African-American	75% own a smartphone, and 23% own a cellphone but not a smartphone [7].	Opportunities to recruit into clinical research where typically underrepresented [17]. Mobilize community connection and support.	Higher prevalence of mobile-only Internet access. Low rates of inclusion in clinical research. Low rates of stakeholder involvement in development process.
Rural populations	65% own a smartphone [21], low rate of broadband internet access at 61% [23].	Potential to transcend geographic space and allow remote visits and appointments.	DMH interventions need to consider infrastructure challenges such as bandwidth, access, and data.
Homeless individuals	Estimates of smartphone ownership range across different methods of surveying. One study found 58% of adults [28]. Ownership rates similar to housed peers in some subgroups (i.e., youth) [29].	Tendency to use Internet to stay connected and seek services. 24/7 access to resources might be beneficial to address structural barriers to access.	Access to technology might overlook other challenges such as keeping phones charged, maintaining phone numbers, and service plans. Higher prevalence of mobile-only Internet access.
LGBTQ	Smartphone ownership does not differ by sexual orientation [35].	Higher rates of seeking mental health information or resources online. Digital spaces allow potential to connect LGBTQ individuals who might lack strong communities or support where they live.	Initial pilot studies show acceptability and feasibility of tailored tools. Culturally sensitive, stigma-free content is important.

conversations [37]. The Trevor Project [38] is a support source providing crisis interventions and suicide prevention services to LGBTQ youth (including a partnership with CrisisTextLine) and provides supports in online spaces. Thus, DMH appears particularly well suited to provide services to this population.

One of the earliest forms of DMH interventions, computerized cognitive behavioral therapy (cCBT) provides a promising opportunity to assist LGBTQ individuals because it can be tailored to specifically target the needs of this group and deliver private assistance that might not be associated with of visiting a mental health provider. For example, cCBT can include content that addresses heterosexism, homophobia, lack of family support, social judgment, and issues about

coming out in a supportive and personalized fashion [39]. Unfortunately, few DMH interventions include these elements [33] even though LGBTQ individuals have expressed favorable views towards the integration of technological tools in their treatment [40]. Despite these challenges—adaptability, mobility, privacy—DMH interventions present an opportunity to overcome some of the barriers of treatment by providing supportive mental health resources to this population [34].

One way in which DMH can potentially impact the mental health of LGBTQ individuals is through the adaptation of currently available DMH technology to more specifically target their needs. One DMH depression intervention, SPARX, was altered by researchers to Rainbow SPARX which contains specific elements that made the services more appropriate for the LGBTQ population struggling with symptoms of depression [41]. For example, the rainbow version includes multiple culturally sensitive script changes to the intervention modules, avatars that can be customized without strict gender norms, and content addressing specific challenges among this population (e.g., coming out, getting bullied). In a qualitative assessment of the application, participants strongly endorsed the effectiveness and acceptability of Rainbow SPARX for treating their depression [41]. In addition, the use of Rainbow SPARX has been shown to significantly reduce symptoms of depression and anxiety, and these effects were maintained at a 3-month follow-up [41]. The successful adaptation of SPARX into a LGBTQ-specific intervention demonstrates that digital self-help resources can be a valuable adjunct to face-to-face therapy for this population.

Tailoring an existing application for use by LGBTQ individuals is one route for providing DMH services; however, it may be even more efficacious to design a novel application that specifically targets LGBTQ issues. Burns and colleagues [42] sought the input of sexual minority men to inform the culturally appropriate design of an application that assists with the management of generalized anxiety disorder and major depression. The end-product of this systematic development process was the application TODAY!, which provides a range of tools that received positive feedback from users [43•]. This ground-up approach ensures stakeholder involvement and allows the DMH to specifically address the issues that are most important to this LGBTQ population.

Research in this area is still in its infancy, and only a few instances of specific DMH interventions for LGBTQ populations exist. However, there is great potential for a positive impact on LGBTQ mental health through digital means. LGBTQ individuals seem to be connecting online and are overrepresented when looking at digital service seekers. Given their tendency to seek resources online, designing culturally appropriate interventions or adapting currently available interventions might meet the unique needs of this group. Future studies should work to test the efficacy of these potential interventions and establish guidelines for the successful development and implementation of DMH for LGBTQ individuals.

Future directions

The state of the evidence and development of DMH interventions for underserved and marginalized populations mirrors themes that are present in DMH

interventions more generally. Work has largely consisted of small pilot studies, many which have demonstrated feasibility and acceptability, but few which have demonstrated large-scale efficacy or scaling. For instance, a 2018 systematic review identified a number of pilot studies for digital interventions in underserved groups, but noted that these interventions usually did not follow-up with an implementation component [44•]. On one hand, this is not surprising, given that focus on underserved and marginalized populations often follows development of more general interventions as demonstrated by our examples of tailoring or augmenting interventions for a specific population. On the other hand, this is extremely disappointing given the discrepancy between the need and supply of available mental health services for these populations and the fact that following initial attempts provides the exciting potential to build and expand. Thus, we offer a few suggestions that might help accelerate and improve work that can increase the impact of DMH among underserved and marginalized populations.

One possibility for the future of DMH is to develop tools that do not require adaptation on the part of the developer to be relevant and appropriate for different populations. This could include language agnostic tools that leverage technology to create interactions based on clinical science that do not have to be conveyed verbally. For example, work has translated therapeutic evaluative condition [45] and attention-bias modification [46] into mobile apps for widespread deployment. It is worth considering how much can be developed that does not require language especially when using digital media. Another possibility, however, would be to allow users of the DMH interventions to contribute to the intervention themselves. Some DMH interventions have leveraged peer involvement [i.e., 47, 48], and peers from different populations could assist in the delivery of content tailored to language or other differences on these general use platforms.

Another important step is increasing the transparency within DMH intervention as to whether individuals from different subpopulations have used that intervention and whether it has worked for them. The question most relevant to any potential user is not whether that intervention has an impact on average but whether that intervention will likely help him or her. Issues of the generalizability of benefits of DMH across diverse groups is key. Some of the work described in this paper, such as determining if DMH interventions contain content relevant for specific groups or having people from groups use an intervention to provide user feedback, is an important first step. But ultimately those responsible for reporting outcomes on the impact of DMH interventions should highlight this information.

Lastly, we offer a word of caution for the advancement of DMH. One area of growth has been the use of artificial intelligence (AI) and machine learning to provide deeply personalized interactions based on individualized understanding. Such methods typically use historically collected data to make predictions about new data being introduced to the model. Concerns have been raised regarding the unwanted introduction of biases by AI and machine learning models [49]. One example of potential problems in such interventions would be an algorithm that can detect depressive symptoms based on automatic recognition of voice in English-speaking patients not being applicable to

Spanish-speaking patients. Furthermore, a smartphone application that adapts a behavioral activation intervention according to emotional state might suggest that the patient can engage in activities such as going to the movies or spending an evening with friends. However, low-income individuals might experience financial and structural barriers that restrict them from engaging in certain types of activities [50•]. For marginalized populations, these biases may result in incorrect predictions or withholding of resources. Ways of overcoming machine bias include using training data of diverse patient populations, ensuring that no group is underrepresented, comparing model accuracy for different demographic and social groups, and acquiring more diverse teams of programmers and researchers, including different academic disciplines, to study the design of fair and ethical models [49]. All of these suggestions align with the broader need for inclusion of diverse populations early and often to ensure broad benefit of DMH interventions. Otherwise, we run the risk of further increasing existing health disparities (Table 1).

Conclusions

It is exciting to think that technologies can help overcome disparities in mental health services and expand access and improve relevance for underserved and marginalized populations. Table 1 summarizes some of the key points synthesized from the various populations we have discussed in this paper. These populations have all been addressed in pioneering work that has illustrated different ways in which technologies might overcome disparities. Despite this initial progress, much work still needs to be done. Pursuing thoughtful use of technology to address mental health needs among underserved and marginalized populations requires an appreciation of the strengths and needs within each group, the technological availability and use of that group, and the interaction of these aspects to appreciate the unique affordances of technology. Evidence is starting to show promise for doing so, but large-scale efficacy, effectiveness, and implementation studies are still lacking. As it stands, DMH interventions still hold a lot of potential to help diverse groups, but now, that potential needs to be translated into reality and action.

Compliance with ethical standards

Conflict of interest

Stephen M. Schueller declares that he has no conflict of interest. John F. Hunter declares that he has no conflict of interest. Caroline Figueroa declares that she has no conflict of interest.

Adrian Aguilera reports personal fees from Care Message.

Human and animal rights and informed consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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- Of importance
- Of major importance

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