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Introduction

The use of digital health interventions and tools has been in the mainstream since at least the early 2000s.[1] However, in the last decade, there has been a boom in innovation and implementation of digital health interventions in the sexual and reproductive health (SRH) field.[2] People have increasingly turned to digital devices for medical information and decision-making, whether searching for symptoms online or using mobile applications to connect with healthcare providers. Reproductive health information is no exception. Need to track your period? There are many apps for that! Need to find a reproductive health clinic? Geolocalised directories have your back. The offer expands to digital platforms focused on menstrual and hormonal health, contraception, fertility awareness, sexual health information, counselling, and so on. Abortion care is no exception to this trend. As the abortion access landscape shifts within a spectrum of legal restrictions, digital health tools like telemedicine platforms, mobile applications, and even social media have become valuable resources to counter restrictive legislation as well as to innovate in healthcare provision.[3]

The availability of abortion medication and information about its safe self-management are essential factors in the decision-making process of having an abortion.[4] Digital tools can help users navigate this process. Digital health interventions have been used in global and public health to self-assess eligibility for medical abortion,[5] support the self-administration of medication,[6,7] assess medical abortion completion,[6,8,9] and inform users about post-abortion contraception options.[10] Similarly, innovation in digital abortion care has also entered the "FemTech" space, a term coined in 2016 by Ida Tin, founder of Clue, a period and ovulation tracking app.[11] This term is meant to encompass health solutions, often digital-based, geared towards cisgender women's health issues primarily focused on reproductive health-related experiences, including both abortion and miscarriage care. While there is no question as to whether users want access to crucial reproductive health information and tracking, there should be a pause to ask how these digital tools have been developed, how end-users are using them, and the range of implications for their health and wellbeing.

Digital health is a broad term referring to the systematic implementation of information and communications technologies, computer science, and data to support informed decision-making by individuals and improve health and wellness

outcomes.[12,13] These interventions can potentially address problems such as distance and access to abortion care, especially in legally restrictive settings where in-clinic abortion care is unavailable. Still, digital health tools for abortion care share many of the underlying challenges faced by the health system: for instance, infrastructure limitations reflected on user experience issues, data privacy and management concerns, and how these tools interact with the healthcare systems at large. These matters need to be addressed in addition to the specific implementation requirements of digital health interventions. They range from ethical and safeguarding issues like the protection of users' data from third parties to accessibility in communities with poor internet and data or where the population has a low digital literacy.[14]

Considering these challenges, this commentary aims to outline what we have learned from developing and implementing three digital health tools for abortion and miscarriage care in Canada, the United States, and Venezuela. These interventions fall into a subset of digital health called mHealth, defined as the use of mobile wireless technologies for healthcare.[12] We group lessons learned into three main categories: human-centred design, data and digital security considerations, and integration with formal health systems and community-based organisations. The geographical focus responds to the current implementation of projects aimed at tackling specific contextual needs. My PostCare in Canada addresses the lack of focused resources for miscarriage care in countries with broad reproductive healthcare access.[15] Euki, developed in the United States but available worldwide, fills the gap of a free, simple, and accurate informational tool and data privacy-oriented period tracker. Finally, Aya Contigo in Venezuela was developed to support self-management and trusted referral access in restricted settings. Our hope is that these insights from mHeath development can serve others working to increase safe abortion access through high-quality and ethical digital health innovation.

Investing in human-centred design is key to meet users' SRH needs and care expectations

The intersection between digital health and self-care is strengthening with the mainstreaming of mHealth technology, changing how we interact with our reproductive health.[14] Innovation in user experience and user interface increases the expectations for both the efficacy and the aesthetics of devices and software.[16] Therefore, digital health tools must provide a smooth and efficient user experience and high-quality care. Human-centred design (HCD) is a methodology that can help developers achieve these goals through iteration.[17] The implementation of this approach is flexible and based on four main principles: understand and address the core issues, be people-centred, use an activity-centred approach, and use rapid iterations of prototyping and testing.[18,19] HCD has been used to develop interventions to improve patient outcomes in a range of health issues.[20] In this particular case, we have used HCD in the development of three digital tools aimed at supporting people after first and second-trimester procedural abortions and miscarriage in British Columbia, Canada,[21] and supporting SRH, including safe medical abortion in the United States[22] and Venezuela.[23]

The HCD of these mobile applications relied on three phases: (1) formative research with users facing barriers to care and (2) design and development that iteratively involved the participation of intended users. For example, through a community advisory team in the US and the engagement of key community stakeholders in Venezuela and Canada; and (3) user-testing and process implementation evaluations to gather feedback on feasibility and acceptability. Conducting HCD in these three cases involved mixed methods such as in-depth interviews, focus groups, and surveys. Similarly, it required a community-based participatory approach that allowed the engagement of different reproductive justice collectives and grassroots organisations to inform the feasibility of introducing a digital abortion care strategy in their communities. Through this process, we learned that HCD becomes a valuable methodology in the context of abortion exceptionalism, where abortion is isolated from other SRH services rather than sitting on a continuum of care. Understanding how care and user experience aspects are unique compared to other SRH topics is essential to incorporate abortion into digital health effectively and, ultimately, within the comprehensive range of SRH services.

Feedback from the HCD process has brought to light significant lessons when exploring the development of digital interventions geared toward improving access to abortion information and

support. The first learning is that initial information seeking, and assimilation on procedural or medical abortion processes and how to access care, can be overwhelming. This was true for users during first-time clinic visits in Canada and the US and those navigating online resources in Venezuela.

To better manage this overload, users should be able to quickly refer to the content they need at different points throughout their abortion journey. In the Venezuelan case, we found that having a live chat with WhatsApp compatibility (the instant messaging application most widely used in the country) was a critical acceptability factor. Through this feature, users could clarify doubts and access psycho-emotional support. The feeling of "having someone there" was highly rated among Venezuelan users.[23] This compares to the desire for warmth, friendliness, and connection from users in the United States[22] and the need for optional post-abortion counselling from Canadian users.[21]

End-users also want abortion information integrated with other resources and not isolated from other related sexual and reproductive healthcare experiences. This exclusion continues to create barriers to what people know about abortion compared to other SRH topics. Integrating safe abortion information with the broader SRH spectrum opens the opportunity to break with abortion stigma and exceptionalism. Users from the United States highly valued this way of presenting abortion information. However, they also wanted to be able to customise the availability of specific content according to what was most relevant to their current reproductive health needs.[24]

Digital security and transparency in data management must be a top priority for protecting users and community stakeholders

Concerns about data privacy and security when engaging with abortion information are of the highest importance when implementing digital health strategies. Safeguarding concerns for end-users, community stakeholders, and service providers must not be treated lightly. Factors such as stigma and criminalisation of abortion contribute to this situation. Even in places where abortion is legally available within the health system, there is still criminalisation of its self-management.[25] Similarly, some users would prefer not to interact with healthcare staff and institutions to keep their abortions private and avoid stigmatising treatment.[26] For these reasons, developers, researchers, and designers must prioritise data security and users' privacy while they interact with abortion information through digital platforms in every aspect of design and implementation.

Beyond the safeguarding of users' data, there are also concerns about its usage by third parties. The overturn of Roe v. Wade in 2022 catalysed an already critical discussion about the weaponisation of reproductive health personal data from health-tracking mobile applications and browser searches. Investigative reporting from major outlets has exposed how users' data could be shared with the private sector and law enforcement agencies.[27] Only in 2022, two women in Indiana and Mississippi were prosecuted after needing post-abortion care. Data from their phones were considered significant evidence in their cases.[28] These examples show that caution is necessary as the public learns more about the afterlives of their reproductive health data and implementers learn how to craft a balance between stigma-free digital spaces for abortion seekers while informing about how to protect users' personal information and safety effectively.

We have implemented some standard practices across our three initiatives regarding data privacy and security. First, we do not store or share information on legal names, physical, or e-mail addresses. Similarly, we include plain language privacy statements within the mobile applications and their websites detailing the type of general information we collect and the purpose of it. Secondly, in response to users' feedback during the HCD process, we implemented the following features: (1) terms like "sexual and reproductive care", "abortion", and even "miscarriage" are not part of the logos or names of these mobile applications, (2) we have implemented a PIN for login that users can set up and modify, (3) likewise, considering some users might share their mobile devices, there is an option to introduce a specific PIN that redirects to an error screen in case they find themselves in a situation where they do not feel comfortable disclosing the contents of the mobile application. These tools allow users to enable the notifications they want and feel safe receiving voluntarily. This is also paired with social media efforts to inform prospective users about these security features and how to better engage with abortion information online.[23] All

three innovations allow users to erase their data from the app whenever convenient without needing an internet connection. In the case of Euki, according to California State and U.S. federal law, data are stored locally and anonymised.[29] Finally, servers for My PostCare and Aya Contigo comply with Canadian data protection regulations that clearly specify that organisations must implement measures, such as passwords and encryption, to process, transfer, record, and assess personal data, as well as promptly notify users about the uses of personal data.[30]

However, considering our three populations (Canada, the United States, and Venezuela), one size does not fit all in ensuring users' safeguarding. In the case of Euki, the mobile application does not have back-end support. Therefore, developers do not have access to users' SRH or identity data, a feature highly ranked by participants during testing and feedback sessions, since they feel their personal information is enclosed in their devices with no access to third parties.[22] In the case of Aya Contigo in Venezuela, its implementation has an important element of community engagement with local SRH organisations and activists. Due to the legal context where abortion is highly criminalised, data privacy and security aspects involved a series of consultations with technical experts on cybersecurity and a legal team. These partners ran risk assessments for both application features and community outreach strategies.

A holistic approach to safeguarding is necessary for the development and day-to-day implementation of digital health strategies with features such as referrals or information about SRH providers. This community-based approach to safeguarding means partnering with local experts on digital security and human rights defenders' protection to conduct assessments and risk evaluations that can be integrated into the digital tool to protect users, community allies, and the implementing organisation.

Digital health tools can enhance users' experience with healthcare systems and community-based SRH organisations

No app is an island. Digital health tools are one of the several resources abortion seekers can use in the network of actors and organisations involved in providing SRH care. These include complex networks of healthcare centres, private practices, community-based SRH organisations, and feminist accompaniment collectives.[31] Digital innovation is not a replacement for any of these stakeholders, but it can be a resource to help users navigate SRH and abortion care ecosystems throughout different stages. However, partnerships with these health systems must be intentional, inclusive, and sustained to achieve synergy. Including SRH providers and organising advocates throughout the HCD process through early engagement in feasibility and acceptability studies, co-design, and implementation can help these allies take ownership of digital health innovation to complement their work.[32]

In developing Aya Contigo in Venezuela, continuous stakeholder engagement laid the foundations for a trusting, transparent, and safe space for partners. They could discuss local adaptations and how the mobile application could better refer and give users information on trusted SRH providers and community-based organisations.[23] This partnership element also increased the application's visibility at "high-traffic" locations such as SRH clinics and youth groups. However, this putting these community embers at the centre implies the design and implementation of a community engagement strategy that can acknowledge and address the already existing barriers of access different communities have, not only to SRH services, but to healthcare in general. Similarly, the experience of implementing MyPostCare in Canada is an example of how digital health tools can play a prominent role at various stages of the abortion care process. Users can utilise the mobile application to know more about what to expect from a procedural abortion and access recommendations on follow-up physical and emotional self-care. These features can make the delivery of in-clinic abortion and miscarriage care more efficient, convenient, and accessible, as well as offer patients an outlet for trusted information.[33]

Users of Euki in the United States described how using a mobile application can support them in filtering and better understanding SRH information that otherwise becomes overwhelming. This "content curation" also has the potential to help them make informed choices and manage interactions with healthcare staff. They referred to the tracking features as essential tools to document health experiences as they could accurately share them with their clinician. This feature is especially relevant for those users from

historically marginalised backgrounds and identities who feel their doctors do not understand their unique health needs – for instance, women of colour[34] and queer abortion seekers who do not see their reproductive health needs met at traditional healthcare centres.[35] However, it is worth highlighting that the lack of representation of LGBTIQ+ abortion experiences was pointed out by users of My Postcare in Canada.[33] Considering all these intersections matters for quality of care. While having clear health records tracked helps establish a more transparent communication with healthcare providers, this is far from completely solving historical power dynamics issues in patient-doctor interactions. Nevertheless, digital health records and tools could be resources that catalyse a shift in this relationship.[36]

Concluding remarks

Digital health tools cannot be exempted from discussions on quality of care.[36] For many abortion seekers, their journey to access care starts by browsing the internet and interacting with digital health tools during different stages of the process. In this sense, digital health tools for SRH and abortion care are already part of the ecosystem of abortion providers. With this comes an exciting opportunity for innovation and breakthroughs in how we think about access to safe and high-quality abortion care.

Through this commentary, we aimed to contribute to current discussions about the role of digital health tools in providing SRH information, services, and supporting self-care interventions. We focused on three critical aspects of development and design of digital solutions that allow these tools to become relevant and safe for users: (1) human-centred design based on participation as a human right and as a way to respond to the users' needs in a way that is sensitive to the realities of their contexts; (2) a respectful, diligent, and transparent use of sensitive personal health information, and (3) an acknowledgment that digital health innovation is never a replacement for high-quality and accessible healthcare systems and strong community-based health organisations and advocates.

As a call to action, we encourage those who are interested in digital solutions for abortion and SRH care to be mindful that innovation requires responsibility toward users and their health. The way forward must include reproductive justice and rights-based perspectives in designing, implementing, and evaluating these digital health strategies and this is only possible when a diverse group of stakeholders come together in every step of development.

Disclosure statement

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