mHealth for transgender and gender-expansive youth: an update on COVID, venture capital, and the cultural in/congruence of revenue-driven sustainability models

Simone J. Skeen[1]^, Demetria Cain[2]^

[1]Department of Social, Behavioral, and Population Sciences, School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA, USA; [2]Department of Psychology, Hunter College, City University of New York, New York, NY, USA

Correspondence to: Simone J. Skeen. School of Public Health and Tropical Medicine, Tulane University, 1440 Canal Street, 2200-11, New Orleans, LA 70112, USA. Email: sskeen@tulane.edu.

Interactive communications technologies (ICTs) are key sites of self-discovery, community formation, health education, and creative expression among the 0.7–3.2% of young people who identify as transgender and gender-expansive (TGE). mHealth interventions intended for TGE users are situated within—and, increasingly, informed by—this rich online milieu. ICTs permit socially isolated users to transcend the limitations of their physical environments, in which TGE social bonds, gender-affirming hormone therapy (GAHT) providers, or physical safety, may be lacking. This is particularly true of TGE youth, who may lack autonomy or in-person support (1). A diverse, innovative range of ICT interventions serves the gender-affirmation needs of TGE users. As noted by Skeen *et al.* (1), these interventions can be classified along distinct lineages: (I) academic medicine, often via NIH-funded clinical trials; (II) human-computer interaction, user experience (UX) design, and adjacent subfields; and (III) TGE-led community technologies, often developed via hackathons and crowdfunding.

Since the initial, July 2020, publication of that scoping review (1), upheavals have occurred within TGE mHealth, with implications for mHealth self-sustainability, broadly. Most can be traced to the COVID pandemic, which disproportionately burdened marginalized subpopulations. Jarrett *et al.* surveyed transgender and nonbinary respondents across 76 countries from April–August 2020,

55% of whom reported diminished access to gender-affirming care due to the pandemic; 38% were less able or unable to live in accord with their genders at all (2). In the U.S., the Centers for Disease Control and Prevention recommended the suspension of in-person appointments. Federal regulations that had restricted reimbursement for telehealth services and barred cross-state practice were relaxed (3,4). These changes vastly expanded access to telemedicine, permitting TGE young people to access primary care, counseling, and GAHT initiation virtually, or via hybrid models of care, typically extensions of established providers (3,4). Presently, telehealth cannot replace key aspects of in-person (particularly pre-surgical) consultation (3), which most TGE youth prefer for GAHT initiation (4). And an "either/or" approach to such questions overlooks the possibility of telehealth-supported specialist consultations and similar hybrid models (4). Emerging evidence shows promise in the acceptability, usability, patient satisfaction, and cost-effectiveness of gender-affirming telehealth, particularly among TGE youth who feel unsupported by their parents (3,4).

Where TGE eHealth in the COVID era departs most radically from the past is in its abrupt, recent, turn toward venture capital (VC)-backed commercialization. Exemplifying this turn are the telehealth services *Folx* and *Plume*. Forgoing any brick-and-mortar presence, both offer GAHT initiation, maintenance (4), and wraparound care tailored for sexually and gender-diverse patients,

^ ORCID: Simone J. Skeen, 0000-0003-0631-4003; Demetria Cain, 0000-0002-9360-9928.

for the cost of a monthly out-of-pocket subscription fee: $100/month, approximately, not including the cost of medication (5). The *Solace* app, covered in Skeen *et al.* (1), is now the flagship offering of VC-backed Euphoria.LGBT Inc., which is developing a suite of TGE-tailored apps. The amounts invested toward their eventual profitability are non-trivial: $29,400,000 to Folx Health across seed, venture, and Series A funding rounds; $14,000,000 raised by *Plume* in a Series A round; and $580,000 to Euphoria. LGBT in pre-seed and crowdfunding, according to the competitor-intelligence platform Crunchbase (6). These VC-backed services are compared in detail atop (*Table 1*).

Responses to these services, among some transgender and nonbinary media-makers, were negative, verging on resistant (7), in a manner that is illustrative of broader, unresolved, tensions inherent to mHealth scale-up and sustainability. In ways, the backlash recalled Gorski *et al.*'s reports of resistance to revenue-generating mHealth implementations that, to the communities they aimed to serve, appeared to commodify longstanding traditions of community-centered care (8). TGE and sexually diverse communities have survived via, and often take pride in, enduring networks of community care, through which specialized medical knowledge, social support, and direct mutual aid are disseminated—often along ICT channels: Tumblr, Reddit, Discord, and many more (1,7). In contrast, *Folx*, *Plume*, *Solace*, and *Bliss*, with their infusions of capital, polished marketing materials, and (in the case of Euphoria.LGBT) upfront emphasis on financial viability, seemed to herald the appropriative, extractive ethos of neoliberalization (7,9). Neoliberal restructuring, hostile to collective models of social welfare, recasts underserved subpopulations as untapped consumers, primed for revenue-generating free-market solutions. Such models, historically, have gained traction through crisis-driven regulatory turbulence and capture (9), such as that which accompanied the initial waves of COVID-19 in the U.S. (3). Yet *Plume*, Folx Health, and Euphoria.LGBT are

TGE- and queer-led. *Plume* and *Folx* offer microgrants for transgender, nonbinary, and questioning patients unable to pay for GAHT (5). *Solace*, alongside other Euphoria. LGBT offerings, is free to use. And, even as their launches have attracted attention, the feature-rich and innovative ecosystem of TGE mHealth has continued to flourish. Updates to the interventions covered in Skeen *et al.* (1), alongside new launches since July 2020, are detailed in Table S1 (available at osf.io/dnt6y).

More broadly, the value proposition inherent to subscription telemedicine, for patients who may lack access to *any* traditional brick-and-mortar providers, is self-evident: ease of access to care is emphasized by a plurality of mHealth projects, worldwide (8). Beyond contexts, such as gender-affirming care, in which unfavorable provider-to-patient ratios are urgent concerns, the consumer appeal of simple convenience is indisputable. Indeed, durable business models are crucial to mHealth self-sustainability, and to population health impact, by extension, regardless of context (8,10). But subscription-based access, over and above the expense of medication may, too easily, translate to exclusivity: a "concierge" model that would leave behind the disproportionate share of TGE people who endure poverty (3). Reflecting this possibility, the negative responses to *Plume*, *Folx*, and *Solace* raise broader questions of whether financial self-sustainability models, adopted late in a mHealth development lifecycle, can undo earlier-established gains in acceptability and cultural congruence.

The growth of GAHT initiation via telehealth has led to calls to closely monitor young TGE patient outcomes (4). *Plume* and *Folx* present prime opportunities to study, and to advance, "queer UX" in eHealth (5). Alongside these calls, we recommend mHealth investigators devote resources to understanding their projects' possible models for financial self-sustainability early in the project lifecycle (8,10), and to the adverse reactions—the resistance—these models may provoke among communities of end-users with strong traditions of self-reliance.

Table 1 Summary of gender-affirmative VC-backed digital health interventions (n=7) launched since July, 2020

Name, description	Modality	HIV prevention–and/or care-focused	Evidence summary	Explicit theoretical grounding	Key/unique features	Gender affirmation dimension	Source
Bliss, a Euphoria.LGBT, Inc. platform, automatically directs a predetermined proportion of a TGE user's income toward self-assigned gender-affirmation goals (which closely mirror those of *Solace*). Examples include "Buying a dress," with a range of cost estimates derived from web sources; and "Start [hormone replacement therapy] [Estrogen+]," with links to *Plume*'s subscription offerings	Smartphone app: iOS and Android	No	No formative, UX, or outcomes research available ("none available" hereafter)	None available	Behavioral self-monitoring; Password protection; TGE-curated informative resources	Embodied*; legal; psychological; social	Euphoria.LGBT, Inc. Bliss LGBT. Version 1.2 [iOS], 1.9 [Android]. 2021
Clarity, a Euphoria.LGBT offering, is a standalone app that permits users to fix their present sense of gender identity, expression, and attractions toward others along a linear female-to-male continuum represented by touch sliders. Cf. *Gendo*	Smartphone app: iOS and Android	No	None available	None available	–	Psychological	Euphoria.LGBT, Inc. Clarity LGBT. Version 1.0 [Android]. 2020
Devotion, another Euphoria.LGBT app, is a lightweight app that provides routine affirmations intended for TGE users. Affirmations are self-selectable to appeal to "content," "anxious," "brave," and "lonely" emotions	Smartphone app: iOS and Android	No	None available	None available	–	Psychological	Euphoria.LGBT, Inc. Devotion LGBT. Version 1.1 [iOS], 1.1 [Android]. 2021
Folx is a subscription telehealth service that offers holistic GAHT service, with "new start/restart" and maintenance pricing tiers, in 33 U.S. states. Additionally, primary care services (nutrition, fertility, sexual health including ED, etc.) are available, plus referrals to local brick-and-mortar providers. *Folx* does not maintain a "brick-and-mortar" (physical location) presence, nor by extension, are in-person services available. Cf. *Plume, GenderGP, QMed*	Telemedicine/online video counseling	No, but PrEP initiation, maintenance, and sexual health services are available	None available	None available	Remote video counseling; TGE-curated brick-and-mortar resources; TGE-curated informative resources	Embodied; psychological; social	Folxhealth.com. Accessed January 29, 2022

Table 1 (*continued*)

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Table 1 (*continued*)

Name, description	Modality	HIV prevention– and/or care-focused	Evidence summary	Explicit theoretical grounding	Key/unique features	Gender affirmation dimension	Source
Plume is a subscription telehealth service that provides virtual consultations for, initiation, instruction (e.g., on self-injection), maintenance of GAHT for patients aged 18–65 years in 33 U.S. states. Prescriptions to local pharmacies and home delivery is included. A range of gender-affirming medications, including hair loss and ED therapies, and letters of support for gender-affirming surgeries and legal name-change documents, are also provided. *Plume* does not maintain a brick-and-mortar presence, nor by extension, are in-person services available. Cf. *Folx, GenderGP, QMed*	Telemedicine/ online video counseling	No	None available	None available	Remote video counseling; TGE-curated brick-and-mortar resources; TGE-curated informative resources	Embodied; legal; psychological; social	Getplume. co. Accessed January 29, 2022
Solace, the flagship app of Euphoria. LGBT, Inc., is a suite of tools tailored for TGE users, including self-assignable goals (differentiated by medical, legal, and social domains) that provide in-depth educational modules on topics such as "Creating a hidden photo vault," "Interacting with the TSA," and accessing GAHT via the above-mentioned *Plume* platform. Integrations with *Bliss* (above) and the TGE-tailored *Windfall* online marketplace are available. Cf. *TransTracks*. Solace Child Mode, adapting these features for caregivers of TGE children, remains, to date, in open Beta	Smartphone app: iOS and Android	No, but "HIV, STIs, & Other Infectious Diseases" education is available	None available	None available	Behavioral self-monitoring; Password protection; TGE-curated informative resources	Embodied; legal; psychological; social	Euphoria.LGBT, Inc. Solace LGBT. Version 3.3 [iOS], 5.0 [Android]. 2022

*, as in our earlier review (1), we replace "medical affirmation" with "embodied affirmation" in order to capture bodily interventions, such as chest-binding and electrolysis, accessible in non-medical settings. Evidence summaries are as of February 2022. Results are limited to English-language (partially, or in full) platforms and records. VC, venture capital; UX, user experience; TGE, transgender and gender-expansive; GAHT, gender-affirming hormone therapy; ED, erectile dysfunction; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Table S1 Summary of technology-mediated (N=21) interventions inclusive of TGE youth: Updates since July, 2020[†] (Skeen SJ, Cain D. mHealth for transgender and gender-expansive youth: an update on COVID, venture capital, and the cultural in/congruence of revenue-driven sustainability models)

Name, description	Modality	HIV prevention– and/or care-focused	Evidence summary	Explicit theoretical grounding	Key/unique features	Gender affirmation dimension
Attuned Voice is a project of Weill Cornell Medical College, Ithaca College and Stony Brook University, and a TGE advisory committee, which aims to broaden the availability of high-quality tools to aid TGE and nonbinary individuals in attaining a voice congruent with their gender identity (11)	Smartphone app: iOS exclusive	No	*Attuned Voice* was developed by an interdisciplinary team of laryngologists, speech language pathologists, mobile developers, designers, and TGE advisors (11). As of February, 2022, it is available exclusively to study participants	*None available*	Behavioral self-monitoring; Biofeedback; TGE-curated informative resources	Psychological; social
Deadname Eraser is an extension of Apple's Safari browser, which allows TGE users to automatically replace their *deadnames*, or gender-incongruent birth names, in online documents. It is open source, with code, and French- and Spanish-language localizations, available on GitHub (12)	Smartphone app: iOS exclusive	No	None available	*None available*	–	Psychological; social
Gendo permits users to track their sense of gender, mood, and record free-text diary entries daily, logging their entries longitudinally in a gender-by-mood scatterplot (13)	Smartphone app: iOS and Android	No	While no outcomes evaluations specific to *Gendo* are discoverable, tracking emotion, mood, activity, and behaviors that may or may not facilitate gender affirmation is a key component of transgender-affirmative cognitive behavioral therapy (TA-CBT; 14)	CBT (15), TA-CBT (14)	Behavioral self-monitoring; User-generated content	Psychological
GenderGP is the titular app for a private UK-based telehealth provider of gender-affirming care. *GenderGP*, operating on a monthly subscription model, both works in partnership with, and aids in filling gaps left by, the UK National Health Service's gender identity development service (GIDS; 16)	Smartphone app: Android exclusive	No	While no outcomes evaluations specific to *GenderGP* are discoverable, the tensions surrounding GIDS and private gender-affirmative telemedicine for TGE youth in the UK are illustrated by Carlile *et al.* (17)	*None available*	Remote video counseling; TGE-curated informative resources; Provider education	Embodied; psychological; social
Gender Tag presents users with a series of highly granular "gender tags," which name and synopsize identities such as genderfluid, demigirl, and agender, among others. Users can add photo avatars to their chosen descriptors and export them for sharing (18)	Smartphone app: Android exclusive	No	None available	*None available*	–	Psychological; social
LifeSkills Mobile presents trans-feminine spectrum users (aged 26–29) with 4 modules to address self-concept and self-esteem; communication in the context of discrimination; education on sexual behavior and gender transition; and motivation and behavioral skills for safer sex, condom use, and substance use. A large-scale efficacy trial of the mobile intervention is currently underway by researchers at UCLA and University of Chicago (19)	Internet/webapp	Yes	Adapted from the in-person, group-based, *Project LifeSkills* intervention, which demonstrated efficacy to reduce condomless vaginal and anal sex acts at 12 months post intervention (20)	Theory of Empowerment (21); Information, Motivation, Behavioral skills model (IMB; 22)	Gamification; TGE-curated informative resources	Psychological
Project Spectra, a collective project facilitated by researchers at Northeastern University, is a free and open-source voice training app that emphasizes affirmation, playfulness, care, and self-determination among TGE users, unconstrained by cis-normative expectations of gendered voice pitch (23,24)	Smartphone app: iOS and Android	No	*Project Spectra* relies on input from a growing, evolving range of Discord community members and Spectra users), who emphasize principled and equitable decision-making throughout development. Methods such as informal polling, decentralized collaborative prototyping, focus groups, and user testing have been employed to this end (23)	*None available*	Behavioral self-monitoring; Biofeedback	Psychological; social
Pryde Voice & Speech Therapy is a suite of voice feminization tools and exercises available for purchase by users who may wish to attain a more feminine voice (25)	Smartphone app: iOS and Android	No	None available	*None available*	Behavioral self-monitoring; Biofeedback	Psychological; social
QMed/Queer Med is a gender-affirmative telemedicine practice serving TGE patients across the southeast U.S., including via GAHT. While certain services, such as testosterone initiation, previously required in-person consultation, the service is now entirely virtual. Uniquely, among GAHT-providing telemedicine services, *QMed* accepts health insurance (26)	Telemedicine/online video counseling	No	None available	*None available*	Remote video counseling	Embodied; legal; psychological
Rate My Voice allows anonymous TGE and other users to submit and review short digital audio samples, assessing each speaker for attractiveness and confidence (27)	Smartphone app: iOS and Android	No	None available	*None available*	–	Psychological; social
Text Me, Girl! provides young trans women living with HIV with a series of 270 unique text messages grounded in theories of health behavior, mapped to stages of the HIV Care Continuum. The interventions aims to improve HIV health outcomes among young trans women experiencing compounding health inequities (28)	SMS/text message	Yes	The recently reported findings of an open-label RCT demonstrated that increased exposure to *Text Me, Girl!* was associated with greater retention in HIV care, viral suppression, and adherence to antiretroviral therapies among a sample of predominantly Black and Latinx/a trans women (28)	Health belief model; socio-cognitive theory; social support theory (29)	HIV testing and counseling; TGE-curated informative resources	Psychological; social
they2ze offers TGE young people a range of informative resources, across legal, employment, healthcare (including gender-affirmation, PrEP, PEP, and HIV testing access), plus educational modules for providers to gain cultural competence working on behalf of TGE youth (30)	Smartphone app: Android exclusive	Yes	While no outcomes evaluations specific to *they2ze* are discoverable, the app was used as an example in a recent asynchronous co-design study that sought to develop sexual education resources for TGE youth. *they2ze* was described as highly promising, but its apparent lack of updates since 2017 dampened interest considerably (31)	*None available*	TGE-curated informative resources; TGE-curated brick-and-mortar resources; HIV testing and counseling; Provider education	Embodied; legal; psychological
Transgender Empowerment by Texting (TExT) is an interactive SMS intervention delivered 4 days a week for 6 weeks by a masters' level intervention coach. The intervention aims to reduce anxiety and depression and increase social support among TGE and nonbinary adults. *TExT* was developed by researchers at Oklahoma State and Southern Illinois University (32)	SMS/text message	No	Reported outcomes (N=14) found reductions in anxiety and depression symptoms, and a non-significant increase in social support pre- and post-intervention. Feasibility and acceptability of the intervention was demonstrated (32)	Minority Stress (33); CBT (15), TA-CBT (14)	–	Psychological
TransLife, developed by an interdisciplinary team that includes transgender health specialists from the St. John's Well Child and Family Center in Los Angeles, aims to promote resilience and adaptive coping strategies among TGE users in order to mitigate suicidal ideation, while capturing longitudinal data on mood patterns. These data are used to tailor recommended coping tips, and to cultivate insights on environmental stressors. User-provided healthcare, mental health, and legal resources are listed. New users are required to commit to a safety plan, stored for use in case of acute suicidality among users (34)	Smartphone app: iOS and Android	No	A recent usability study (N=16) demonstrated early acceptability, engagement and usability among TGE users. Participants were particularly excited by the mood-tracking features (34)	Minority Stress (33)	Behavioral self-monitoring; Personal safety; TGE-curated brick-and-mortar resources; TGE-curated informative resources	Embodied; legal; psychological; social
Trans Voice Studio presents TGE users with a voice spectrogram tool, plus links to additional voice-training resources (35)	Smartphone app: Android exclusive	No	None available	*None available*	Behavioral self-monitoring; Biofeedback	Psychological; social
திருநங்கைகள் (*Thirunangaikal*): *Transgender* Welfare is the official mobile app of the Transgender Welfare Board, Social Welfare and Women Empowerment Department, of the Government of Tamil Nadu, India. Through the app, *thirunangai* (trans women) and *thirunambi* (trans men) can apply to the state's TGE-tailored social welfare programming for housing, education, and gender-affirming healthcare coverage (36,37)	Smartphone app: Android exclusive	No, but HIV testing is integrated within broader gender-affirming medical services accessible via the app (37)	None available	*None available*	TGE-curated brick-and-mortar resources; TGE-curated informative resources	Embodied; legal; psychological; social
TransTracks is a personalized transition tracker, allowing TGE users to log timestamped changes to their faces and bodies, presumably in response to GAHT. The app includes a "deep cover" mode, in which it masquerades as an innocuous transit app (38)	Smartphone app: iOS and Android	No	None available	*None available*	Behavioral self-monitoring; Personal safety	Embodied; psychological
Trans Women Connected focuses on gender affirmation; personal goal-setting; PrEP education; listings on PrEP providers, and medical, legal, educational, and housing services (39)	Smartphone app: iOS and Android	Yes	In response to the ongoing COVID pandemic, *Trans Women Connected* has added educational modules on COVID safety and mitigation strategies. A 2-arm cluster RCT of *Trans Women Connected* is underway (Christina J. Sun, PhD, e-mail communication, January 2022)	*None available*	HIV testing and counseling; TGE-curated informative resources; TGE-curated brick-and-mortar resources; User-generated content	Embodied; legal; psychological; social
[unnamed private TGE resource app[‡]] This app conceals resources for TGE youth, including external links to *Refuge Restrooms*, behind an innocuous menu of mindfulness tools. Its home-screen icon does not signal TGE affinity	Smartphone app: iOS and Android	No	None available	*None available*	Personal safety; TGE-curated informative resources	Embodied; legal; psychological; social
Voice Tools: Pitch, Tone, & Volume presents users with voiceprint, playback, tones to emulate, and related tools for TGE-tailored voice training (40)	Smartphone app: iOS and Android	No	None available	*None available*	Behavioral self-monitoring; Biofeedback	Psychological; social
Voice Pitch Analyzer presents users with a visualization of their voice's pitch, benchmarked against traditional, cis-centric female and male ranges (41)		No	None available	*None available*	Behavioral self-monitoring; Biofeedback	Psychological; social

*, As in our earlier review (1), we replace "medical affirmation" with "embodied affirmation" in order to capture bodily interventions, such as chest-binding and electrolysis, accessible in non-medical settings. [†], No substantive updates to *Binder Reminder, Christella VoiceUp, EVA, Transgender Pelvic Health, Patch Day, Project Moxie, QueerDoc, Refuge Restrooms, Safe Transgender Bathroom App, ShotTrax, unnamed Washington, DC telehealth intervention*, were discoverable. The *TechStep* trial remains ongoing. Cf. Skeen *et al.* (1). *Spokane Trans Map* is no longer available in iOS or Android. [‡], Because rendering specific details of this app discoverable on the open web could subvert its ability to protect the privacy of young TGE and questioning people, we forgo specifics in this report. Evidence summaries are as of February 2022. Results are limited to English-language (partially, or in full) platforms and records. ED, erectile dysfunction; GAHT, gender-affirming hormone therapy; RCT, randomized controlled trial; TGE, transgender and gender-expansive.

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