MyPEEPS Mobile App for HIV Prevention Among Transmasculine Youth: Adaptation through Community-Based Feedback and Usability Evaluation

Dorcas Adedoja, Lisa M. Kuhns, Asa Radix, Robert Garofalo, Maeve Brin, Rebecca Schnall

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Abstract

Background: Transgender men (TM) and transmasculine youth are at high-risk for acquiring HIV. Growing research on TM demonstrates increased HIV risk and burden compared to the general US population. Despite biomedical advances in HIV prevention, there remains a dearth of evidence-based, sexual health HIV prevention interventions for young transmen (YTM).

Objective: The purpose of this study is to detail the user-centered design methods to adapt and improve the interface and usability of the MyPEEPS Mobile app for young transgender men.

Methods: The MyPEEPS Mobile app for YTM was adapted through a user-centered design approach which included iterative review of the adapted prototype by expert advisors and a youth advisory board. The app was then evaluated through a rigorous usability evaluation.

Results: MyPEEPS Mobile is among the first mHealth interventions developed to meet the specific needs of YTM to reduce HIV risk behaviors. While many of the activities in the original MyPEEPS Mobile were rigorously developed and tested, there was a need to adapt our intervention to meet the specific needs and risk factors among YTM and transmasculine youth. Findings from this study describe the adaptation of these activities through feedback from a youth advisory board and expert advisors. Following adaptation of the content, the app underwent a rigorous usability assessment through an evaluation with experts in human computer interaction and targeted end-users.

Conclusions: Usability and adaptation findings demonstrate that the MyPEEPS mobile app is highly usable and perceived as potentially useful for targeting HIV risks behaviors in YTM

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Authors: Dorcas Adedoja, Lisa M. Kuhns, Asa Radix, Robert Garofalo, Maeve Brin, Rebecca Schnall

Background. Transgender men (TM) and transmasculine youth are at high-risk for acquiring HIV. Growing research on TM demonstrates increased HIV risk and burden compared to the general US population. Despite biomedical advances in HIV prevention, there remains a dearth of evidence-based, sexual health HIV prevention interventions for young transgender men (YTM). MyPEEPS Mobile is a web-app and builds on extensive formative community-informed work to develop an evidence-based HIV prevention intervention. Our study team developed and tested the MyPEEPS Mobile intervention for 13-18 year old cisgender young men in a national randomized trial, which demonstrated efficacy to reduce sexual risk in the short term – at 3-month follow up.

Objective. The purpose of this study is to detail the user-centered design methods to adapt, improve the user interface and enhance the usability of the MyPEEPS Mobile app for young transgender men and transmasculine youth.

Methods. The MyPEEPS Mobile app for YTM was adapted through a user-centered design approach which included iterative review of the adapted prototype by expert advisors and a youth advisory board. The app was then evaluated through a rigorous usability evaluation.

Results. MyPEEPS Mobile is among the first mHealth interventions developed to meet the specific needs of YTM and transmasculine youth to reduce HIV risk behaviors. While many of the activities in the original MyPEEPS Mobile were rigorously developed and tested, there was a need to adapt our intervention to meet the specific needs and risk factors among YTM and transmasculine youth. Findings from this study describe the adaptation of these activities through feedback from a youth advisory board and expert advisors. Following adaptation of the content, the app underwent a rigorous usability assessment through an evaluation with experts in human computer interaction (N=5) and targeted end-users (N=20).

Conclusions. Usability and adaptation findings demonstrate that the MyPEEPS mobile app is highly usable and perceived as potentially useful for targeting HIV risks behaviors in YTM and transmasculine youth.

Keywords: HIV, Mobile App, transgender men, transmasculine, MSM

INTRODUCTION

Transgender men (TM) and transmasculine youth are at high-risk for acquiring HIV. Growing research on TM demonstrates increased HIV risk and burden compared to the general US population. A recent review was among the first to systematically estimate HIV risk and burden in TM in the US. In this review, there was a high prevalence of HIV (3.2%; lab confirmed) and high rates of unprotected sexual intercourse (24.5%), which has been strongly associated with HIV acquisition.[1] High rates of sex work (13.1%) were also reported in the review, and research suggests the marginalization of sex work increases likelihood of seroconversion.[2] Previously undescribed HIV risk behaviors and contextual factors point to the immediate need for the development and testing of HIV prevention interventions among TM, particularly younger TM and transmasculine youth who may be at increased risk due to vulnerability associated with young developmental age and increasing sexual activity.

Despite biomedical advances in HIV prevention, there remains a dearth of evidence-based, sexual health HIV prevention interventions for young transmen (YTM). The current Centers for Disease Control and Prevention (CDC) compendium of evidence-based interventions (EBIs) for HIV prevention has no EBIs for YTM[3]. In response to this need, our study team sought to adapt MyPEEPS (Male Youth Pursuing Empowerment, Education, and Prevention around Sexuality), a theoretically driven intervention for YTM. The MyPEEPS intervention was originally developed for cisgender YMSM and targets social-cognitive and cognitive-behavioral factors based on best practices for behavior change, emotion regulation, and HIV intervention (e.g., knowledge, self-efficacy, and behavioral skills) within YMSM-specific social contexts[4]. The MyPEEPS scenarios include, for example, emotionally activating and cognitively complex situations involving partner-specific factors (e.g., older partners), experiences of social stigmatization (e.g., by race and/or sexual orientation), and sexualized contexts (e.g., online sexual partner interaction, under the influence of alcohol or drugs) and specifically address emotional regulation and minority stress which are salient issues facing adolescents at risk for acquiring HIV. Our study team developed and tested the

MyPEEPS Mobile intervention for 13-18 years, in a national randomized trial, which demonstrated efficacy to reduce sexual risk in the short term – at 3-month follow up.[5] MyPEEPS Mobile is a web-app and builds on extensive formative community-informed work to develop an evidence-based HIV prevention intervention. [4 6-8]

However, the MyPEEPS Mobile interventions were not developed specifically for YTM. We explored adaptation to the specific needs of YTM inclusive of their unique underlying mechanisms of sexual risk and HIV acquisition. To achieve this goal, we conducted focus groups with 49 YTM in the four MyPEEPS Mobile sites, which generally supported usefulness of the content but highlighted important limitations requiring adaptation, including those related to specific health concerns (e.g., pregnancy prevention, disclosure) and body parts, body types, and sexual partner dynamics[9]. The purpose of the study described herein was to build on our prior success with the MyPEEPS Mobile intervention to fill a gap in HIV prevention intervention by adapting MyPEEPS Mobile to YTM, aged 15-25 years, an age group that captures a period of increasing risk of HIV infection[10], and assess the usability of the app among the target population. This paper outlines key user-centered design methods to adapt and improve the interface and usability of the MyPEEPS Mobile app for YTM.

METHODS

The MyPEEPS Mobile app for YTM was adapted through a user-centered design approach for mobile health apps,[11-13] which included iterative review of the adapted prototype by expert advisors and a youth advisory board (YAB) from June to November 2022. The app was then evaluated through a rigorous usability evaluation from January to April of 2023. Details on the timeline for each phase of the study are illustrated in Figure 1.

Ethical Considerations.

All study activities were reviewed and received approval by the Columbia University Institutional Review Board. Study participants provided written informed consent. All electronic data was stored

in a certified environment. All study data was stored on secure HIPAA-compliant servers at the CUMC campus. All study data will be kept in password protected was maintained in a completely secure and HIPAA-compliant environment. Youth Advisory Board Members received $75 for each session in which they participated. Experts received $250 for reviewing the curriculum. Usability testing participants $40 for their time and experts who participated in the heuristic evaluation received $150 Amazon gift codes.

Youth and Expert Advisory Board Review

Sample

To adapt the MyPEEPS Mobile app, we recruited expert advisors and end-users. Expert advisors included those with expertise in mHealth app development, adolescent health, sexual health, and gender minority youth health who were identified by the Investigative Team. The youth advisory board included transgender men and transmasculine youth between the ages of 18 and 24 years, who reported condomless sex with partners assigned male at birth. The YAB members were considered consultants and the research team had the final say in all adaptations. While the research team made the final determination about the app content, YAB members who reviewed the finalized curriculum expressed unanimous approval. The recruitment letter was circulated to community-based organizations and a recruitment flyer was shared via social media platforms to recruit end-users, using a convenience sampling approach.

Procedures

Both groups reviewed a pencil-and-paper prototype of the intervention content for salience of the narrative content, flow of modules, and features and characteristics of the app activities and characters. Expert advisors provided feedback by email in two iterative rounds. The YAB reviewed the app content, images and activity structure of the original MyPEEPS Mobile app, as well as initial adaptations and new activities proposed by the expert advisory group to optimize salience to users.

The YAB met 10 times to review the paper-and-pencil prototype for the app over a period of 5 months (June-November). They reviewed all activities, covering 3-5 activities in each of the initial five sessions. Extensive notes were recorded in each meeting and the prototype was then revised and reviewed in weekly study team meetings. In the final five meetings, YAB members reviewed the revised prototype and responded specifically to outstanding questions. In between meetings 9 and 10, the expert advisory group provided input on the prototype and it was revised accordingly. In the final meeting of the YAB, these additional revisions were reviewed to produce a beta version of the app for usability testing.

Usability Testing

Sample

End-users were eligible if they (1) were aged 15-25 years; (2) assigned female sex at birth; (3) self-identify as a man, transgender man or transmasculine; (4) understood and read English; (5) lived in the US; (6) owned a smartphone; (7) self-reported condomless receptive anal or vaginal penile sex with a partner assigned male at birth in the past year; and (8) self-reported HIV negative or unknown status. To recruit participants for the usability testing, we paid to post study ads on social media platforms including Instagram, Facebook, Discord, and Lex. Promotional materials were also shared with community-based organizations. A sample study advertisement which was approved by our Institutional Review Board and posted on social media sites is illustrated in Figure 2.

Procedures

Interested participants completed a screener through REDCap to determine if they were eligible for the study based on the inclusion criteria detailed above. Once determined to be eligible for usability testing, end-users completed usability testing procedures over Zoom conferencing platform with the Research Coordinator. Following completion of written informed consent, participants reviewed the adapted MyPEEPS Mobile app content, images, and activity structure to identify usability issues and improve the overall content and functionality of the MyPEEPS Mobile

App for YTM. Participants were asked to open the MyPEEPS Mobile app and complete 13 use cases (see Table 1) while using the app. Participants were instructed to "think aloud" while navigating through the app and completing tasks. Notes were taken by the study coordinator to record feedback and assess ease or difficulty of completing each task.

At the end of the visit, participants were asked to complete a survey through Qualtrics XM. Participants self-reported demographic information and completed the Health Information Technology Usability Evaluation Scale (Health ITUES) and the Post-Study System Usability Questionnaire (PSSUQ) to assess usability of the MyPEEPS app. The Health-ITUES is a 20-item scale which consists of 4 subscales: Impact (items 1-3); Perceived Usefulness (items 4-12); Perceived Ease of Use (items 13-17); and User Control (items 18-20). Each item is rated between 1 (strongly disagree) and 5 (strongly agree), with a higher score indicating a more usable tool. The PSSUQ is 16-item scale divided into 3 subscales: System Usefulness (items 1-6); Information Quality (items 7-12) and Interface Quality (items 13-16). Each item is rated between 1 (strongly agree) and 7 (strongly disagree), with a lower score indicating a more usable tool. Participants were compensated $40 in the form of an Amazon gift code for completing usability testing.

Heuristic Evaluations

Sample

Our sample was comprised of experts trained in human-computer interaction and had published in the field of informatics. Participants were identified by the Principal Investigator and were invited to participate via email invitation.

Procedures

Heuristic evaluations took place over Zoom and consisted of completion of 13 use cases (Table 1), a survey and 3 open-ended questions. Open-ended questions were: (1) Thinking back to the MyPEEPS Mobile App, how do you think transmasculine youth who want to prevent HIV

exposure would apply the information, lessons, or activities in their daily lives? (2) How do you perceive this app would be of relevance to transmasculine youth who want to prevent HIV exposure? and (3) How easy or intuitive is it to navigate through the app to perform a particular task? Zoom visits were audio-recorded as experts remotely tested the app interface and provided feedback. Participants were compensated $150 in the form of an Amazon gift code.

In the survey, usability experts rated the app according to Nielsen's 10 heuristics: (1) visibility of system status; (2) match between system and real world; (3) user control and freedom; (4) consistency and standards; (5) help users recognize, diagnose and recover from errors; (6) error prevention; (7) recognition rather than recall; (8) flexibility and ease of use; (9) aesthetic and minimalist designs; and (10) help and documentation. Each heuristic was rated between 0 (not a usability problem) and 4 (usability catastrophe).[14]

RESULTS

Youth Advisory Board and Expert Advisors

A total of 11 youth advisory board (YAB) members provided feedback on curriculum adaptations, with an average of 4 participants attending each meeting. Most of the YAB members (64%, n=7) were recruited via social media. The YAB was diverse in terms of race and ethnicity. YAB participants identified as Black (n=4), White (n=5) and biracial (n=2). A small minority of YAB members also identified as Hispanic/Latino/x (n=2). YAB members were aged 23 on average (range=21-24) and were largely from the northeast (n=7), with the balance of the group from the south (n=4) and west coast (n=1). The mean age of the YAB was 23 years (SD= 3 years).

The original MyPEEPS Mobile App included 21 mobile app activities.[15] The revised app was adapted for YTM and includes 25 total activities. Most of the activities and the original focus of the app on social-cognitive and cognitive-behavioral factors was maintained in the adapted version. The primary adaptations for the underlying mechanisms of risk unique to YTM are listed in Table 2.

These can be summarized as: changes to MyPEEPS characters (look and feel); minor wording changes within the activities for specificity to YTM; and major changes, including removing, expanding or adding activities, as detailed below.

In terms of the MyPEEPS characters, more background information (to increase identification with the characters) was added, the characters were given ages, racial backgrounds, and hobbies. Updates were made to their pronouns, gender, and sexuality descriptions in the Underwear Personality Quiz, which is a "warm up" activity to familiarize participants with the characters (Activity 4). In addition, one character was made physically larger to reflect variation in physical body sizes and skin blemishes were added to characters to appear more like adolescents.

Minor changes included updates to common phrases and slang, adding more current emojis, and including information about gender, gender expression, anatomy and sexual behaviors relevant to YTM and transmasculine youth throughout the app. A resource page with a list of trans-affirming social and health organizations was developed. Hyperlinks to these resources were included throughout the app.

Major changes to activities included removing one activity called "Rubber Mishap" that was viewed by the YAB as more appropriate for a younger age group (i.e., too "silly" for this age group). Five activities originated from another app designed by members of the team for young transgender women (LifeSkills Mobile[16]), including "Jeopar-T" (activity #10), "Safer Injection" (activity #16), "Disclosure and Safety" (activity #18), "Red Flag, Green Flag" (activity #19), and "Healthy Relationships" (activity #21). These activities were adapted for YTM and added to the MyPEEPS app. For example, Jeopar-T, which is a game to identify fact from fiction as it relates to health topics, was adapted to discuss health topics relevant to YTM including potential pregnancy, birth control options, and gender-affirming hormone therapy. The Safer Injection app was adapted to focus on correct injection steps for injectable testosterone. Disclosure and Safety focuses on safer disclosure of transgender status to sexual and romantic partners. Red Flag, Green Flag is an activity focused on critical appraisal of potential online sexual and romantic partners and Healthy

Relationships is an activity to describe and reinforce characteristics of healthy sexual and romantic relationships.

In addition, several activities were revised or expanded for YTM, including the following activities: “Bulls-I” (activity #2), “Sexy Settings” (activity #6), “HIV True/False” (activity #9), and “Tackling Testing” (activity #13). The original purpose of the Bulls-I activity was to create awareness of the different social roles held by everyone as a precursor to goal setting, however, in this adaptation we repurposed the graphic and concept to prompt users to identify their own body parts by name. This allowed for more in-depth and affirming discussion of sexual behaviors. Sexy Settings was adapted for an older age group by including information on statutory consent and public sex laws as well as more scenarios involving sex work. The HIV True/False activity was updated with more detailed information on PrEP and a set of prompts to motivate PrEP adherence (for those individuals taking PrEP). Tackling Testing (originally called, Testing with Tommy) was adapted to maintain the original purpose (de-mystify HIV testing), but also to address other health concerns among YTM, including pregnancy potential and PrEP access.

Usability Testing and Heuristic Evaluations

A total of 20 YTM participated in usability testing and self-identified as Black (n=2), White (n=11), Asian (n=1), and Multiracial (n=3). Usability testing participants who identified as Hispanic/Latino/x (n=5) were Puerto Rican (n=3) and Mexican (n=2). The mean age of usability testing participants was 21 years (range=18-25) and they were largely from the Northeast (n=10), with the balance of the group from the West (n=5), South (n=3) and Midwest (n=2). Participants’ rated their perceived usability of the app through the PSSUQ[17] and Health ITUES.[18] Mean (S.D.) scores are reported in Table 3. The mean score of the overall PSSUQ was 1.63 (SD 0.65) and the Health ITUES was 4.50 (0.24) reflecting strong user acceptance of MyPEEPS YTM App. The mean usability score in this study was above the cut-point of 4.32 on the Health ITUES used to define usability of health IT tools.[19]

A total of 5 usability experts participated in heuristic evaluations. Responses to the ten

heuristics each round ranged from no usability problem to minor usability problems, with only one participant identifying a major usability problem for user control and freedom and are listed in Table 4. The expert specifically noted that there was no quick way to exit a module or the app in its entirety.

Open Ended Feedback

Open-ended feedback was organized by the constructs of the PSSUQ: 1) system usefulness, 2) information quality and 3) interface quality.

System Usefulness

Some participants shared they believe the app could be useful to younger transgender men and transmasculine people. A 19-year-old White non-binary transgender man (U2) found the information in the app "accurate and very detailed". He stated young people would be able to "comprehend it well". When discussing the Red Flag, Green Flag activity about online dating safety a Black 23-year-old genderqueer transgender man (U19) said: "I like how it describes for people what is safe and what isn't when it comes to looking at profiles because when I was young I didn't know." He went on to say the activity was, "Pretty accurate to what can happen in real life. Simple and wholesome while showing the reality of things." Several participants conveyed appreciation for the content warnings throughout the app before sensitive material. They also expressed excitement about the trophies that appeared after they completed each activity. A 21-year-old biracial transgender man (U13) indicated that the trophies made him feel "accomplished." Another participant (U20) described the trophies as "fun."

Information Quality

Several end-users expressed that the dialogue between app characters did not align with how young people speak with one another. On the other hand, a 19-year old White boyflux (someone who feels fluctuating masculinity[20]) transgender man (U10) shared that he felt the information in the app was presented "in a clear way".

Some participants expressed they learned new information by viewing the content.

Participants U4 and U19 shared: “I didn’t know trans men could take PrEP.”

Interface Quality.

A 23-year-old Black and Puerto Rican non-binary man (U17) described the characters as “cute”. On the other hand, there were concerns with interface quality with multiple usability testers criticizing the presence of long blocks of text in the app. A 22-year-old White transgender man (U4) said: “When I see big chunks of text my brain just doesn’t want to read it.”

User navigation difficulties were identified. A 19-year-old Asian genderqueer participant (U1) described the font as small and difficult to read. When discussing the Red Flag, Green Flag activity a 19-year-old White non-binary trans man (U2) shared: “I had to figure out where to swipe or how to swipe.” In response, the app text was condensed to eliminate large text blocks and the remaining text was enlarged throughout the app. Red Flag, Green Flag activity instructions were also rewritten for clarity in response to this feedback.

DISCUSSION

MyPEEPS Mobile is among the first mHealth interventions developed to meet the specific needs of YTM to reduce HIV risk behaviors. While many of the activities in the original MyPEEPS app were rigorously developed and tested, there was a need to adapt our intervention to meet the specific needs and risk factors among YTM and transmasculine youth. Findings from this study describe the adaptation of these activities through feedback from a youth advisory board and expert advisors. Following adaptation of the content, the app underwent a rigorous usability assessment through an evaluation with experts in human-computer interaction and targeted end-users.

The primary adaptations of the app were focused on MyPEEPS characters (look and feel) and removing, expanding and adding activities for specificity to YTM. These changes are consistent with our prior formative research suggesting that the MyPEEPS Mobile app, while resonating with YTM with regard to the basic HIV educational information and sexual scenarios, lacked transmasculine specificity in both its narrative content and its graphics[9]. In this adaptation, the character graphics and backgrounds were revised to reflect the realities of YTM. These adaptations are essential to

ensure that interventions have saliency for the target population.[21]

In addition to these adaptations, we made other more substantial ones. This included removing and adding activities, maintaining the underlying curricular components namely, the underlying social-cognitive theory which framed the intervention, and content on: emotion regulation, HIV knowledge, self-efficacy, and behavioral skills within YTM-specific social contexts[4]. These include myths specific to YTM HIV and pregnancy risk ("Jeopar-T," activity #10), hormonal needle injection ("Safer Injection," activity #16), disclosure of trans status to sexual partners ("Disclosure and Safety," activity #18), choosing potential partners ("Red Flag, Green Flag," activity #19), and relationship dynamics ("Healthy Relationships," activity #21), all of which have been emphasized as important to sexual safety among trans men and transmasculine youth. This content was aligned with a previous HIV prevention intervention for YTM .[22]

Findings from the usability evaluation suggested that this app is highly usable and perceived as useful to target end-users. These are critical factors in ensuring uptake of the app and have been demonstrated as harbingers to behavior change in our previous studies. Furthermore, there was a usability factor which was found to be a critical error. This was addressed prior to the launch of the app in our feasibility trial.

While the inclusion of a diverse group of YTM through both a YAB and usability testing was a clear strength, a notable weakness is that no youth under 18 years were included in this formative work, which is a limitation given the app's intended use is for YTM ages 15-25 years. Therefore, conclusions suggesting MyPEEPS will have high usability are limited for those 18 years of age and older. This is also notable since youth <18 years often have added considerations toward privacy and security, e.g., if their parents will see what they are entering into an app, particularly for topics such as this that are sensitive and could inadvertently out them to their parents.

Limitations

The MyPEEPS Mobile app was adapted for YTM by a YAB comprised primarily of racial and ethnic minority YTM from the northeastern US and so may not be generalizable across all racial

and ethnic groups and areas of the US. YAB meeting attendance was poor due to an average of 4 out of 11 youth board members attending each session. MyPEEPS Mobile content largely focused on relationships between YTM and cisgender men, which is not fully representative of the broader transmasculine community nor YTM sexual networks.

Conclusion

Usability and adaptation findings demonstrate that the MyPEEPS Mobile is highly usable and perceived as potentially useful for targeting HIV risks behaviors in YTM and transmasculine youth. This study focused on the adaptation of an existing evidence-based intervention. A larger randomized controlled pilot study (NCT 05424718) is planned which will assess the feasibility of the app as an HIV prevention intervention for YTM and transmasculine youth.

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Data Availability

The data generated and analyzed during this study are available from the corresponding author on reasonable request.

Table 1. Use Cases for testing MyPEEPS YTM App to Assess Usability

1	Open the MyPEEPS App
2	Log in to the MyPEEPS App
3	MyPEEPS Profile Set Up
4	Complete the Bulls-I Activity
5	Complete the “BOTTOMLINE” Activity
6	Complete P’s On-Again BottomLine Activity
7	Complete the Move Up, Move Back Activity
8	Complete the Jeopar-T Activity
9	Complete the Tackling Testing Activity
10	Complete the Safer Injection Activity
11	Complete Disclosure and Safety Activity
12	Complete Red Flag, Green Flag Activity
13	Log out of the Account

Table 2. Primary adaptations of the MyPEEPS Mobile App to address the underlying mechanisms of risk unique to YTM

Activity	Status	Purpose	Adaptation
1.MyPEEPS Profile Set Up	Original	• Profile set up	• Added option for users to type in or select their pronouns • Added feature allowing app users to select multiple different pronouns
2.Bulls-I	Revised	• Naming the user's body parts	• Revised so that users can name their own body parts, which are piped into activities throughout the app
3.BottomLine	Original	• User specifies their sexual safety practices	• Added "almost always" or "rarely" options • Added the definitions of condom and dental dam
4.Underwear Personality Quiz	Original	• Ice breaker • Introduce app user to characters	• Added age, hobbies, sexuality descriptions (e.g., Tommy is polyamorous), race/ethnicity descriptions (e.g., Nico is biracial), gender identity for each character (e.g., as trans men, transmasculine, and/or non-binary) • Added sprouting facial hair and acne to characters
5.P's On-Again Off-Again BottomLine	Original	• Introduce P, Nico, and P's new boyfriend • Introduce sexual safety dilemma	• Updated slang, old language viewed as outdated • Added an emojis to the conversations to reflect common usage
6.Sexy Settings	Revised	• Educate about the impact sexual settings may have on sexual safety practices	• Allowed users to select multiple answers for each setting • Added blurb about statutory consent and public sex laws • Emphasized discussion of safety level • Added sex work scenarios
7.Going Downhill Fast	Original	• Educate about the impact substance use may have on sexual safety practices	• Updated language around Viagra and Cialis to be clear the use of it is not studied in transmasculine youth • Added sentence about how drugs may be abused to cope emotionally or due to emotional distress • Added more recent street

			names for drugs (Ex. Rush for poppers)
8.Move Up, Move Back	Original	• Educate about disadvantage and privilege in society and how it can impact sexual and safety practices	• Removed mother/father/brother/sister and used more generalized and gender-neutral family terms • Added questions about gender and gender expression • Added a question about incarceration of family members • Add half step for people who may have an invisible disability • Added weight as a marker of status in society
9.HIV True/False	Revised	• Educate about HIV and HIV prevention	• Shortened text throughout this activity • Added information about injectable PrEP • Included information about how to get PrEP for free or at a low cost • Included information about taking PrEP for 21 days is necessary to reach maximum effectiveness for transmasculine people
10.Jeopar-T	Added	• Educate and address misinformation and myths about transmasculine health	• Adapted for trans men and transmasculine health • Included information about different methods of taking testosterone • Included information about birth control options to inform youth that testosterone is not a form of birth control • Included language about potential challenges in early stages of gender affirming hormone therapy like acne, and other symptoms that will wane with time • Added alternatives to binders, like high impact sports bras (Tomboy X), that can be worn while doing physical activity or swimming
11.Checking In On Your BottomLine	Original	• Check in about BottomLine	• No additional changes

12.P Learns About Safer Sex	Original	• Educate on healthy ways to cope with difficult emotions	• Removed P on the way to the clinic video because it did not resonate with lived experience of YTM • Re-purposed images from video to describe a more salient scenario, i.e., how P feels upset with himself for not using condoms with Rodney
13.Tackling Testing	Revised	• Educate about HIV/STI testing and PrEP	• Split animation into shorter videos, including a short video addressing reproductive health • Include potential pregnancy scenario as part of the testing visit • Updated provider language to more current HIV testing practices • Added captions to videos • Added information about what youth can do to talk about safe sex if they don't have a trusted adult to ask
14.Spread Out	Original	• Educate about the chance of HIV exposure based on sexual act	• Changed activity name from "Well Hung???" to "Spread Out" • Distinguished between front hole sex and anal sex • Spelled out acronyms of sexually transmitted infections
15.12 Steps to Effective Condom Use	Original	• Educate about how to properly use an external condom	• Added 12 Steps to effective internal condom use • Updated paragraphs after internal and external condom use lists
16.Safer Injection	Added	• Educate about how to safely inject hormones	• Adapted to include information about steps for safely injecting testosterone
17.Checking In On Your BottomLine Again	Original	• Check in about BottomLine	• No additional changes
18.Disclosure and Safety	Added	• Provide information on how to safely disclose trans status to sexual and romantic	• Adapted for salience to transmasculine youth • Re-centered the activity around the trans app user and decentered how a potential partner could react • Emphasized that disclosing is not "a big deal" and can be

		partners	straightforward • Emphasized the need to disclose in a safe place (trusted public settings, around others they trust, or virtually) if app user chooses to disclose • Added for app users to be alert and relaxed before disclosure • Settled on using "direct, assertive, and honest" language when disclosing • Made activity interactive by creating potential response panels from a partner • Included partner disclosure of HIV status and anti-viral usage to remain undetectable
19.Red Flag, Green Flag	Added	• Educate about safer online dating	• Added gender to each online profile • Added picture to each online profile • Added information about how location features can be turned off on dating apps • Added information about how photos can be screenshotted on dating apps despite app screenshot blocking • Added information about avoiding partners who fetishize trans people • Added information about encountering fake dating profiles
20.Peep in Love	Original	• Educate about how intense feelings can impact sexual behavior • Educate about practicing direct communication	• Minor changes to boyfriend character to gear toward young adults, i.e., boyfriend (Rodney) is 17 and works at a movie theatre
21.Healthy Relationships	Added	• Educate about healthy and unhealthy relationship dynamics	• Describe healthy and unhealthy relationship characteristics • Apply these characteristics to a relationship scenario
22.4 Ways to	Original	• Educate about	• Adapted to include references

Manage Stigma		different types of coping approaches in stigmatizing scenarios	to transmasculine identity as a stigmatized status with related examples
23.Get a Clue!	Original	• Educate about responses in unique sexual settings and circumstances	• Removed sexual innuendos to respond to YTM sensibility, e.g., “COCKtails” changed to “cocktails”
24.Last Time Checking In On Your BottomLine	Original	• Check in about BottomLine	• No additional changes
25.BottomLine Overview	Original	• Review BottomLine	• No additional changes

Table 3. PSSUQ and Health ITUES Mean (S.D.) Scores Across End-Users (N=20)	
Measure	Score
PSSUQ overall [a]	1.72 (0.63)
System usefulness	1.22 (0.57)
Information quality	2.11 (0.57)
Interface quality	1.71 (0.55)
Health ITUES overall [b]	4.50 (0.24)
System impact on daily life	4.54 (0.25)
Perceived usefulness	4.49 (0.32)
Perceived ease of use	4.81 (2.16)
User control	3.83 (0.30)
[a]Rating score from 1=best to 7=worst (16 items). [b]Rating score from 1=worst to 5 = best (20items).	

Table 4. Expert Rating of Usability of MyPEEPS YTM App Guided by Neilsen's Heuristics						
Nielsen's Heuristics Range 0= not a usability problem – 4= usability catastrophe	Round 1	Round 2	Round 3	Round 4	Round 5	Mean (SD)
(1) Visibility of system status	0	2	2	2	2	1.6 (0.89)
(2) Match between system and real world	0	1	0	2	2	1 (1.00)
(3) User control and freedom	2	3	2	2	0	1.8 (1.09)
(4) Consistency and standards	1	2	0	1	0	0.8 (0.84)
(5) Help users recognize, diagnose, and recover from errors	0	0	0	0	0	0 (0)
(6) Error prevention	0	2	2	2	2	1.6 (0.89)
(7) Recognition rather than recall	0	2	0	0	2	0.8 (1.09)
(8) Flexibility and efficiency of use	0	2	0	0	0	0.4 (0.89)
(9) Aesthetic and minimalist designs	0	1	2	0	0	0.6 (0.89)
(10) Help and documentation	0	2	2	2	0	1.2 (1.09)

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Supplementary Files

Figures

Timeline of Data Collection.

Sample Study Recruitment Material.