An mHealth intervention to enhance coping skills and mental health among MSM living with HIV in China: intervention development and feasibility pilot study

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Abstract

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Men who have sex with men (MSM) bear a disproportionate burden of HIV and mental health problems in China, hindering HIV-related care engagement and medication adherence. mHealth interventions have shown promising effects in improving mental health outcomes. Working closely with Shanghai CSW&MSM Center (SCMC) and Centers for Disease Control and Prevention, Shanghai (SCDC), we aim to address the urgent mental health need and health disparities among MSM living with HIV by developing a culturally appropriate mHealth intervention. Based on needs assessment results, we developed a multi-level, mHealth intervention with a focus on individual skills training and community staff capacity building. The partnership with SCMC has been crucial and mutually beneficial to intervention development. The strengths and priorities of the community stakeholders identified through needs assessment

were critical to the selection of coping skills for MSM living with HIV, the design of SCMC staff training to facilitate delivery, and the component of weekly skill groups to enhance peer learning and intervention engagement. In the needs assessment stage (***Chapter 1***), we interviewed 20 stakeholders, including MSM living with HIV, staff from a community-based organization, and staff from the CDC in Shanghai. The study found that stress from multiple socio-ecological levels, lack of individual coping skills, and scarcity of psychosocial services highlighted the importance of multi-level interventions for MSM living with HIV in China. To develop an mHealth intervention (***Chapter 2***), the researchers used intervention mapping, the behavioral intervention technology model, and human-centered design and cultural adaptation model. The mHealth intervention, named *Turning to Sunshine*, consisted of individual skills learning through a mobile app, skills learning group, and on-demand phone coaching. The intervention aimed to improve mental health outcomes for MSM recently diagnosed with HIV by helping them survive emotionally intense moments, change emotional expression to regulate emotions, and reduce emotional vulnerability, as well as build community capacity for mental health support. A feasibility pilot study (***Chapter 3***) is ongoing and to assess intervention acceptability, feasibility, app usability, and evaluate the preliminary efficacy of the intervention. The feasibility pilot study is a 1:1 randomized control trial (n=31), with a 4-week long intervention and treatment-as-usual control group. Results showed high acceptability and feasibility of the intervention. Compared to the control group, intervention participants demonstrated greater improvements in depression, emotion regulation, HIV mastery, life satisfaction, and coping efficacy. These promising findings suggest that this mHealth approach may be beneficial for improving mental health outcomes among MSM living with HIV in China, warranting further investigation through larger randomized trials.

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Chapter 1. Stress and Coping among Men Who Have Sex with Men Living with HIV in China: A Qualitative Study with Implications for Multi-level Intervention Development

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Abstract

Objective: Men who have sex with men (MSM) bear a disproportionate burden of HIV in China and are particularly vulnerable to mental health difficulties. This study aimed to identify unmet needs of MSM living with HIV to inform the development of a multi-level intervention ***Methods:*** We interviewed stakeholders (*N*=20) through videoconferencing, including 15 MSM living with HIV, five staff from a community-based organization serving gender and sexual minority individuals, and four staff from the Centers for Disease Control and Prevention in Shanghai, China. ***Results:*** Following the stress and coping theory, four themes emerged: 1) stress from multiple levels; 2) individual coping, interpersonal support, and social services; 3) current functioning; and 4) unmet needs and service gaps. ***Conclusions:*** Examining the stress and coping process among MSM living with HIV from a socio-ecological lens is especially important in the collective cultural context. The interactive nature of the stress from multiple socio-ecological levels, lack of individual coping skills, and scarcity of psychosocial services highlighted the importance of multi-level interventions to meet the needs of MSM living with HIV in China.

Keywords*:* Stress and coping; socio-ecological framework; HIV; MSM; China; intervention development

Introduction

Globally, almost one million people die from HIV/AIDS on average every year (Roth et al., 2018). In China, men who have sex with men (MSM) bear a disproportionate burden of HIV, accounting for a quarter of the new HIV cases each year (Zeng et al., 2016). The introduction of antiretroviral therapy (ART) and increased access to it has transformed the quality of life and increased the life expectancy for people living with HIV (PWH) (Gordon et al., 2020). Nevertheless, mental health problems such as depression and anxiety are elevated among PWH compared to general populations (Nanni et al., 2015). Intense emotional reactions and extreme behaviors such as suicide attempts have also been reported (Chen et al., 2022). The prevalence of anxiety symptoms is elevated among MSM living with HIV (21%-42%) in China, compared to HIV-negative MSM (12%-26%). The prevalence of suicidal ideation ranged from 11% to 26% among HIV-infected MSM in China (Sun et al., 2020).

The stress and coping framework (Lazarus & Folkman, 1985) is commonly used to understand the elevated rates of mental health conditions among PWH. When individuals perceive a situation to exceed the currently available resources (i.e., stressful), coping efforts are activated. Coping is defined as a cognitive or behavioral response to a perceived stressful situation (Lazarus & Folkman, 1985). Certain coping strategies (e.g., direct action, positive reappraisal) are associated with positive mental health outcomes among PWH (Moskowitz et al., 2009). PWH face stressors from multiple aspects of their lives, such as HIV treatment engagement, medication adherence, medication side effects, HIV-related stigma (Moskowitz et al., 2009). Qualitative studies have revealed that the stress caused by living with HIV leads to chronic emotional challenges and persistent emotional distress among PWH (Snedker & Herting, 2016; Turner & Kelly, 2000). The stress is exacerbated among MSM living with HIV due to their

sexual minority identity, which is often a target of discrimination and violence in some regions of the world, including China (Altman et al., 2012; Wang et al., 2019; Yang et al., 2020). MSM living with HIV in China experience stress from multiple sources (Sun et al., 2020). Individuals experience considerable distress due to the HIV-related stigma, lack of legal protection against employment discrimination of sexual minorities and PWH in China, and the deeply rooted value of filial piety and responsibility of "procreation" (Huang et al., 2020; Yang et al., 2020) (Li et al., 2015).

Addressing the cluster of stressors and improving the psychosocial well-being of MSM living with HIV in China requires multi-level services that address factors across individual, interpersonal, community, institutional, and structural levels in the socio-ecological model (Kaufman et al., 2014). The current stress and coping literature in the context of PWH has several gaps that need to be addressed to inform the development of such services. First, studies on the coping process are highly individual-focused and stripped of the social context (Moskowitz et al., 2009). Coping strategies were categorized in coping measures (e.g., avoidant, active problem-focused coping) that allowed little space to take into account the interaction between coping and the existing environmental factors such as availability of family support and social services. Quantitative studies PWH in China found positive coping strategies (such as problem solving) are associated with reduced psychological distress while avoidant coping was associated with higher depression and anxiety (Chan et al., 2006; Meade et al., 2010; Zhu et al., 2020). However, whether the coping method led to desirable outcomes (e.g., increased positive affect and resolution of problems) is dependent on the environmental factors. For example, seeking social support would only lead to a decrease in negative affect when the environment responds positively to individuals' needs while resulting in increased stress when the effort is met

with social rejection (Drydakis, 2022). Second, most qualitative studies on stress and coping processes among PWH in China focus on one or two levels in the socio-ecological framework. One such example is a study that explored means of stigma-related coping among PWH and examined both intrapersonal, interpersonal coping strategies, and interpersonal factors, while the community services and structural level policies that shape the stress and coping process are missing (Zhang et al., 2014). No study to date engaged multiple stakeholders to identify unmet mental health needs by capturing perspectives from PWH, their social network, and staff from HIV-related community and institutional services through government organizations. Third, emotional distress was rarely the focus of attention for qualitative studies on PWH in China, despite its impact on long-term psychological wellbeing (Stewart-Brown, 1998). The multidimensional nature of stress was reduced down to the practical aspects of HIV-related stressors, such as medication and treatment engagement (Liu et al., 2016).

To inform the development of a multi-level intervention that addresses mental health needs among MSM with HIV in China, we need to understand the stress and coping process across multiple levels in the socio-ecological framework. Stakeholder interview is an effective method to gain a holistic picture of a community's needs that are shaped by factors from multiple levels (Kaufman et al., 2014). Emotional distress is common among people living with other chronic illnesses as well. It is important to note that although the focus of this study is on HIV, the findings from this study could offer insight into the study of other illnesses in other global regions. The objectives of this qualitative stakeholder interview were to: 1) describe the stress and coping among MSM living with HIV in China; 2) examine how individual coping efforts interact with existing community and institutional resources by embedding the stress and coping

in a larger socio-ecological context; 3) identify service gaps and targets for multi-level interventions.

Method

Design

This qualitative study is the needs assessment stage to inform development of a culturally appropriate digital intervention for MSM recently diagnosed with HIV. Using a community-based participatory approach, we established partnerships with Shanghai Municipal Centers for Disease and Control and Prevention (SCDC) and Shanghai Center for Sex Workers and Men who have sex with Men (SCMC) and formed a study team that comprised one SCDC staff, one SCMC staff, and one MSM living with HIV, and the first author. The study team collaboratively refined study procedures, developed interview guides, interpreted and synthesized findings through shared decision making and mutual learning.

Participants

Participants in this study include stakeholders whose experience and expertise could inform study design and intervention development, including MSM living with HIV, SCMC, and SCDC staff who work with people recently diagnosed or living with HIV.

MSM living with HIV

The SGM population is difficult to reach in the current study context. Privacy concerns around HIV status and sexual orientation were significant barriers to participants recruitment. To overcome these barriers in the recruitment process, the study team designed the participants recruitment information sheet and informed consent with careful wording, to emphasize the

protection of participants' privacy (e.g., camera off during interview) and that the qualitative interview data presented in research activities (e.g., publications) will not be identifiable.

Individuals tested positive at SCMC were added to a WeChat group, which serves as a forum for HIV-positive individuals to share their experiences, ask/answer questions and a platform for SCMC to share any updates about HIV treatment. SCMC has gained trust from the SGM community through years of serving the community. WeChat is a widely used mobile application that is commonly used for free chat messaging in China. Therefore, we decided to have SCMC staff introduce the study to members in the Wechat group and send out eligibility screening surveys to those who expressed interest in the study.

The inclusion criteria for MSM living with HIV include: (1) age 18 years or older; (2) HIV positive; (3) engaged in sex with a man in their lifetime; (4) already started ART; and (5) have the means to receive online interviews (e.g. internet, smartphone). Moreover, participants filled out a PHQ-9 questionnaire and were included if their score was below 15, indicating none-minimal to moderate depression. The reason for this was to capture people who might benefit from a low-intensity mental health intervention. Due to the disruption of the pandemic, recruitment was conducted in three rounds from April 2021 to May 2022. All study participants who met the inclusion criteria provided written consent to participate in the study.

SCDC and SCMC staff

We recruited staff from SCMC whose job responsibilities centered around providing pre- and post-diagnosis counseling for the community to initiate linkage to HIV-related care. Similarly, Shanghai CDC has staff members designated to conduct medical check-ups and phone follow-ups with people living with HIV to ensure long-term treatment engagement. We recruited staff

from Shanghai CDC to gain more understanding of policies and government regulations around HIV-related services that shape the experience of MSM recently diagnosed with HIV. The inclusion criteria for staff members at Shanghai CDC and SCMC were as follows: (1) age 18 years or older; (2) work with individuals living with HIV.

Procedures

The team discussed and refined study procedures and semi-structured interview guidelines through biweekly online meetings (Table 1). After the interview guide was finalized, the lead author conducted one-on-one online interviews in Mandarin using videoconferencing software with camera off. The online interview lasted 60 to 120 minutes and was recorded. Demographic information was collected via online survey after the interview. The recordings were transcribed using an online service (Xunfei AI transcribing service) and verified for accuracy by the first author. Each participant received $20 to compensate for their time and contribution to the study. This study was approved by the institutional review boards at the University of Washington.

Data Analysis

Interview transcripts were imported into the qualitative analysis software Atlas.ti (Version 9.1.3). Transcripts were in mandarin and coded in English by the first author and third author. A combination of deductive and inductive coding was used to analyze the data. This approach provides a clear direction for conceptualizing the data with the flexibility of incorporating unique experiences and novel information from the interviews (Nguyen et al., 2022). Data analysis was an iterative process that included five stages (Table 2) (Elo & Kyngäs, 2008; Fereday & Muir-Cochrane, 2006). The first author (LW) and third author (WH) coded two transcripts to generate the codebook, which was reviewed by the second (JM) and last author (WY). The remaining

transcripts were divided between first and third author to complete coding. Disagreements in the coding process between the first and second authors were resolved through extensive discussions and consultations with senior authors.

We used member checking and analysis memos to enhance the trustworthiness of the study results. The first author (LW), second author (JS), and the last author (WY) all have experience with qualitative research and working with people living with HIV or other chronic illness (Liu et al., 2016; Yuwen et al., 2017). Analysis memos involved detailed notes of decision-making points across stages of data analysis and interpretation. Member checking examined the accuracy of the results in relation to individuals' experience. The analysis results were summarized and presented to participants who agreed to receive followup questions regarding the interview.

Results

Demographic Characteristics

Among the 17 participants eligible for the study, one individual refused to participate due to health reasons and one withdrew from study 10 minutes into the interview, due to privacy concerns. Table 3 presents the demographic characteristics of the participants living with HIV (N = 15), SCMC staff (N = 5), and SCDC staff (N = 4). The majority of the HIV positive individuals received college education or above (12/15, 80%), employed (13/15, 86.7%), and earned more than 5,000 RMB monthly (~ 685 USD, 10/15, 66.7%). About half (53.3%) of the participants received their diagnosis within the past 6 months (relative to the interview date). The majority of the HIV-positive participants (9/15, 60%) had mild depression suggested by PHQ-9.

Stress and Coping across Socio-Ecological Levels

Stress and coping processes were nested in a larger social context and thus conceptualized using a socio-ecological framework (Figure 1). Receiving the diagnosis was stressful at the individual level, the social impact of which rippled through interpersonal, community, institutional, and structural levels. The cascade of stressors further contributed to emotional distress among individuals. Adjusting to living with HIV required ongoing individual coping efforts and environmental support. SCMC and CDC staff recognized the complexity of multilevel factors playing into individuals' adjustment and emotional responses. This study captured a snapshot of how the participants were doing (i.e., their outcomes) at one time point (i.e., time of interview) along a dynamic journey of adjustment. We identified gaps where participants' psychosocial needs were not met due to inadequate individual coping strategies and/or coping resources at multiple levels to inform intervention development.

Theme 1. Stress from Multiple Levels: Lived Constantly in Fear after the initial shock

The moment of diagnosis was described by some participants as experiencing an emotional breakdown or "shock". Thoughts related to death, stigma, and future plans flooded into their mind, accompanied by a wide range of intense emotions, including intense fear, angry, guilty, ashamed, helpless, hopeless, and suicidal. Emotionally overwhelmed, they were not able to process the treatment related information during the post-diagnosis consultation.

> *I was in shock and my brain was not working. I took notes when [a staff at CBO] explained the steps to initiate HIV treatment but did not remember anything. I couldn't understand the notes I took at that time.*

A long-term adjustment phase gradually unfolded as individuals started medication. The emotional trajectory of fear, shame, and sadness revealed the compounded impact of factors from multiple levels in the socio-ecological framework (Figure 1).

At the individual level, the initial intense fear of death gradually transitioned into chronic anxiety. The uncertainty around physical health, medication side effects, and disruptions of future life plans caused worries that often spiraled into a panic state. Internalized HIV-related stigma and shame also increased fear and anxiety. Internalized HIV-stigma surfaced as harsh and negative self-judgment, where participants reported feeling inferior to those who were not infected with HIV. Some felt dirty, contaminated, and that their body was not whole/complete anymore.

> *I regret that I used to have a healthy body and now I have to live with this chronic illness. It's gonna be my whole life. I also regret that I am now incomplete and dirty.*

Due to the relational nature of Chinese society, individuals were particularly affected by the interpersonal implications of HIV-diagnosis, such as disclosure to family and friends. Participants weighed the risks (e, g., social rejection) and benefits (e.g., social support) of disclosure, and the quality and dynamics of their existing relationships. The value of family responsibility caused both sadness and shame for some participants, as they perceived decreased ability to provide for their family.

> *My parents are divorced. I live with my mom and my younger sister. I'm scared that I can't take care of them in the future. I've been the breadwinner of this family.*

Caring for others' health and safety and perceived risk of HIV transmission caused participants to walk on eggshells, especially around their loved ones. These interpersonal implications caused

individuals to feel like a burden to others. Together with insomnia, fatigue, lack of appetite, and suicidality, they formed a cluster of depression-like symptoms.

> *I felt like I should stop socializing with others (to not infect them with HIV), such as having dinner with them. I wanted to isolate myself. Sometimes I have thoughts like I'm inferior to other people. A lot of negative emotions towards myself.*

At the community level, some participants perceived the current online HIV+ and MSM community to be hostile, with discriminating comments on MSM living with HIV. Lacking a positive and supportive community, living with HIV was isolating and led to loneliness, sadness, and shame.

> *People online often point their fingers at people like us. They think we (PWH) should only hang out with PWH and should not harm/destroy other people's lives.*

At the institutional level, the discriminating behaviors from healthcare providers further intensified shame of being a person living with HIV and anxiety of interacting with the health system.

> *I went to a tertiary hospital in Shanghai because of a fever. They thought I had COVID and asked if I had any chronic illness…I told them I had HIV. The physician at that time seemed scared…He kept asking me questions about how I got HIV. Questions like "Did you get infected because you had sex with another man?" A lot of questions that concerned my privacy. I answered them but I felt extremely uncomfortable.*

At the structural and policy level, limited options of free ART regimen, CD4 and viral load testing, and the high cost of medications outside of the government plan caused financial stress

for participants. Additionally, lack of employment protection for persons with HIV threatened their job security and exacerbated their financial stress.

> *I lived constantly in fear. Because you finish one month of medication and have to pay for the cost of the next month. It was very expensive. I did not know how to cope with all of these. It was emotionally painful.*

Theme 2. Individual coping, interpersonal support, and social services

Participants employed coping strategies such as avoidance, problem-solving, and distraction, while receiving coping assistance through social support, services through SCMC and SCDC, and societal level anti-stigma events.

Individual coping efforts and interpersonal support. Most participants found it challenging to cope with the intense emotions in the early stage, despite the post-consultation service provided by SCDC and SCMC. Participants adopted denial, emotional suppression, rumination, and social withdrawal. On the extreme end, one participant quit his job to fully isolate himself. Some participants resorted to overworking or watching TV shows all day to block out and distract themselves from distressing emotions and thoughts about the diagnosis. However, attempts of blocking and suppressing emotion often backfired and did not relieve emotional pain for participants long term.

> *I was already depressed (pre-HIV diagnosis). This was a huge shock. I felt so horrible that I just lied in bed the whole day watching Friends. I just kept watching until the sun went down. I'd get out of bed then and have some food and take the medication. Then I went back to bed and continued to watch the show.*

Problem-solving combined with acceptance was the main strategy participants used to regulate their anxiety and fear. They sought information from trusted sources, strategically disclosed HIV status to friends and/or family, and actively changed their lifestyle used to maximize social support and minimize negative impact of disclosure. Through active engagement with activities hosted by SCMC and SCDC, some individuals maintained connection to the community and cultivated a sense of belonging. Role models among peers living with HIV were crucial in generating hope, social learning of coping and problem-solving skills among those who were newly diagnosed. Participants struggled with the anxiety around uncertainty of the disease progression and its impact while attempting at accepting the reality. Individuals found acceptance difficult and emphasized being patient with oneself.

> *I went to an in-person gathering at SCMC. People shared their experiences living with HIV. Many of them have been taking medication for years. I saw that people were pretty healthy and felt less worried about myself.*

Generating positive emotions was another coping strategy, through engaging in pleasurable activities and finding meaning and value in their life. Familial responsibility as an important value rooted deeply in Chinese culture prevented some participants from ending their lives. Participants talked about creating value by helping other newly diagnosed individuals through providing encouragement and emotional support. Some were willing to but felt reluctant to share their personal story for fear of negative reactions due to HIV-related stigma within the HIV positive MSM community.

He took us to karaoke and told me a lot of people there had HIV. I thought the diagnosis was people's privacy and he did not respect that and probably would not respect mine either. I did not want to socialize with him too much…

Social services at CBO and CDC. CBO and CDC collaborated closely to provide services for individuals newly diagnosed with HIV, including post-diagnosis consultation, in-person gathering, forums, phone call follow-ups. The post-diagnosis consultation and forums aimed to provide information and normalize the diagnosis for newly diagnosed individuals to reduce fear and anxiety. Most SCDC and SCMC staff incorporated emotional check-ins in their work with individuals tested positive for HIV during post-diagnosis consultation and follow-up phone calls. Genuine and caring attitude from the staff members earned the trust from the individuals over time and hence they felt cared for and were more open to advice and guidance.

The work of SCMC and SCDC overlap with a few differences in the focus of service. **First**, the emotional intensity differs between individuals receiving services from SCMC and SCDC. SCMC staff helped individuals to get through distressing moments immediately after diagnosis, while SCDC staff observed more chronic anxiety through long-term follow-up calls. **Second**, the goal of service differs between SCMC and SCDC. SCMC focused on the social aspects and specialized in targeted sub-population outreach. SCMC mainly serves MSM, sex workers, and transgender individuals. Staff members described SCMC as a "bridge to the community" for newly diagnosed individuals. For example, as part of the post-diagnosis consultation, the SCMC staff invited MSM tested positive to join a WeChat group chat created and monitored by the SCMC. Many participants found the WeChat group to be a great place for obtaining the latest HIV related information and getting their questions answered by peers. This connection cultivated a sense of belonging and helped participants identify role models. SCDC focused more

on clinical management including consultation around clinical care and medical appointment follow ups to encourage engagement in medical care. SCDC also works on policy advancement such as reducing financial burden through including more medications under free government ART regimens. The HIV-awareness Day sponsored by SCDC aims to educate the public about HIV-related knowledge and reduce HIV-related stigma.

Theme 3. Current functioning

Long-term adjustment outcomes were shaped by ongoing coping. At the individual level, the struggles with distressing emotions and thoughts at the time of diagnosis often persisted into the present. Level of connectedness with the community, HIV treatment engagement, and medication adherence differed across individuals.

Most individuals reported resuming their routines at some point after their diagnosis, with adjustments made to incorporate HIV treatment in their life. Underneath this seemingly positive outcome of "back to normal life", participants described constant struggles with the vicissitudes of emotions since the day of diagnosis, despite the overall decreased intensity of negative emotions such as fear and hopelessness. For those clients who reported suicidal ideation, suicidal ideation subsided as time went by but did not completely disappear. Participants described that they still had good and bad days and that sometimes the negative emotions were overwhelming.

> *It's been a while. Every time I took medication, I could feel strong emotions coming up. Even right now when we are talking about this, the overwhelming emotions are like roaring waves in the ocean. All the emotions mixed together like spices.*

Participants made efforts to prioritize physical health by forming healthy habits such as a regular sleep and workout schedule. Nevertheless, some observed their physical health gradually

declined. It was difficult for the participants to accept the changes in their physical health and disruptions to their envisioned life trajectory due to the positive HIV diagnosis.

> *I had planned to study abroad. But now with HIV I had to think about how to find a doctor in a new country and learn about the local policy related to HIV treatment. It is too complicated. So I gave up on going abroad. I also won't change my job for a while. HIV diagnosis will make it very difficult to change my job.*

Individuals differed in the duration of adjustment to reach the new normal, with some taking more time and detours than others. Participants who had mental health conditions prior to receiving the HIV diagnosis had more challenges adjusting to living with HIV. One such participant had depression and a history of suicide attempts, coupled with chaotic family relationship and an unstable social support network, reported extended period of self-isolation and despair.

> *My father always had drinking problems. He can get violent when he is drunk. I left home hoping to stay on campus, but my school refused to let me stay because of my previous suicide attempt.*

At the interpersonal and community level, the outcomes differed across individuals. Some individuals reported improved quality and closeness of friends and family relationships after the disclosure of HIV-status. In contrast, others were rejected by their family after disclosure, which forced them into homelessness. While some individuals stayed connected with the HIV-positive community and utilized it as a source of support and gained a sense of belonging, others reported minimal engagement with the group activities held at SCMC and SCDC out of privacy concerns

and lack of trust in the community. The latter group tends to heavily rely on their romantic partners or family, with some remaining isolated.

> *I stayed connected to the online community and my hope increased seeing them sharing their lives. I felt less lonely. Less depressed than before.*

At the time of the interviews, all participants were on ART. Almost all participants were able to adhere to a daily medication regimen, increase their CD4 counts, and reach viral suppression. One individual reported still having difficulty accepting their HIV diagnosis. According to SCMC staff, pill burden, side effects, and lifestyle (e.g., late nights and lack of regular work schedule) are major reasons for poor adherence.

Theme 4. Unmet needs and service gaps

Overall, the adjustment outcomes reflected unmet mental health needs due to lack of knowledge and skills around mental health management at the individual level and larger social service gaps in providing mental health support. While many participants expressed needs and interest in mental health services, very few individuals obtained help from therapists due to the lack of mental health professionals, high cost, and low trust. Most relied on digital apps and self-help books to learn strategies to cope with distressing emotions and thoughts. One participant said he found someone to help him download Headspace on his phone and have been using that to cope with anxiety, especially before sleep. Participants appreciated the attempted support from close friends and family members and pointed out that sometimes the support was provided when they were not ready to receive it. They also felt some friends and family could not exactly understand them and they would prefer to talk to a peer who was diagnosed with HIV and has lived experience.

The lack of psychological support from SCMC and SCDC staff members was a major gap identified by MSM living with HIV. Most staff from SCMC and SCDC recognized the need for providing psychological support, but they felt ill-equipped to provide appropriate support due to a lack of mental health training. To make up for the lack of mental health training, staff members emphasized the importance of being empathetic towards the patients. One CDC staff believed that mental health support is not necessary, and that extra support and attention will create pressure and exacerbate stigma against them.

> *If you just treat them like one of us, why do they need psychosocial support? Aren't we all doing fine? If you treat them as persons living with HIV, a patient, they might feel pressured and feel the attention was unnecessary.*

Other service gaps that are not related to mental health identified by patients were lack of timely response to adjustment of medication regime to address medication side effects, limited number of free viral load and CD4 count testing, and lack of timely follow up after regular physical exams. Individuals also wanted SCMC to provide services to provide legal support around employment discrimination.

Member Checks

We conducted member checks with 6 participants. Participants overall agreed that the summary of results was consistent with their experience. They expressed relief that they were not alone in having these struggles. A few participants emphasized that the summary about ongoing anxiety and uncertainty in their future especially resonated with them.

Discussion

To our knowledge, this is the first study on MSM living with HIV in China that embedded stress and coping processes within the socioecological framework to understand community's needs and inform multi-level intervention development. The journey of adjusting to living with HIV as a chronic process that was shaped by the socio-ecological environment. Four themes emerged, including 1) stress from multiple levels; 2) individual coping, interpersonal support, and social services; 3) current functioning; and 4) unmet needs and service gaps. The emotional impact of the HIV diagnosis lingered into the present. Results suggest that individual coping skills training and community-level mental health services are needed to prevent the development and worsening of mental health symptoms.

Interactive nature of stress in a collective culture

The interactive nature of the stressors from multiple socio-ecological levels was especially impactful in the collective Chinese culture. This highlights the importance of interventions that address stress from multiple socio-ecological levels. The dashed line in Figure 1. delineated the different levels of stress that interact with each other. For example, the internalized stigma at the individual level interacted with and was reinforced by HIV-related stigma at the community, institutional, and structural levels. The shame and fear drove individuals into self-isolation and were exacerbated by HIV-related discriminating comments from friends and family. This interactive view of stress is consistent with the approach to identify behavior change factors for HIV prevention and care (Kaufman et al., 2014). Understanding individuals' stress experience from the broader lens of a socio-ecological framework is especially important considering the social implications of the HIV diagnosis and the relational nature of Chinese society (Zhou,

2007). Individuals from collective cultural settings are more motivated to fit in and experience more distress when deviating from social norms (Kitayama, 2002). Studies on culture and stigma found PWH in collectivist societies experiencing heightened HIV-related stigma (Liamputtong, 2013). Individuals tend to interpret the diagnosis from a moral lens as bringing shame to family. Therefore, family could be a source of stress depending on their reaction to the diagnosis (Ho & Mak, 2013).

Generating positive emotions

The coping process for Chinese MSM was inseparable from the larger socio-ecological framework (Figure 1). Individuals' ability to cope with emotions was limited and heavily relied on friends and family (when available). Some utilized the community resources such as activities hosted by SCMC and SCDC. With a few exceptions such as meditation or mindful breathing, most of the individual-initiated coping efforts involved generating positive emotions through engaging in social activities and value-oriented behaviors (e.g., helping others). Positive emotions, independent of negative emotions, are predictive of less psychological distress, increased resilience, and overall mental wellbeing (Tugade et al., 2004). It is similar to behavioral activation for depression, where pleasant activities are scheduled to increase positive emotions (Cuijpers et al., 2007). Participants used problem-solving to identify role models and address their HIV-related treatment questions and challenges by resourcefully utilized online platforms, services at SCMC and SCDC, and healthcare providers. Although problem-solving could be an effective strategy to reduce uncertainty, acceptance is needed, recognizing that it is unlikely to remove uncertainty completely in the case of living with HIV (Solomon et al., 2014). Accepting that an illness or injury as part of one's life is associated with greater quality of life

and lower level of depression and anxiety (Aaby et al., 2020). Individuals could benefit from balancing problem-solving and acceptance to strategically regulate emotions.

Implications for multi-level interventions

Individuals lack the ability to cope with emotional distress. Participants could benefit from expanding the individual coping toolbox to more effectively regulate their emotions when support from the social environment is not available. Coping interventions developed to enhance coping skills demonstrated effectiveness in improving mental health outcomes, especially cognitive behavior and stress management interventions (Harding et al., 2011). Given the lack of mental health professionals in China and HIV-related stigma (Feng et al., 2010; Zhao et al., 2017), peer-delivered intervention could leverage role models' positive influence in the community to model effective coping and generate hope (Burke et al., 2022).

At the interpersonal level, disclosure interventions might benefit PWH by increasing their social capital, relationship quality, emotional wellbeing, and access to care (Ding et al., 2011; Zhang et al., 2021). Additionally, relationship-based interventions focused on communication and support skills can help close friends or family members to better understand individuals living with HIV and provide appropriate support. Family support, when available, was regarded as most helpful by PWH in China (Yu et al., 2016). Information sessions about HIV for close family members and partners could reduce their misbeliefs around HIV and increase their ability to cope as a family, which may ease the tension in relationships after disclosure (Eustace, 2013).

The interview results revealed a lack of direct emotional support and mental health resources for individuals at the community and institution level. Mental health services need to be established and integrated into the current HIV care continuum. With a severe shortage of mental health

professionals, training of staff at the community level is potentially an efficient solution to narrow the mental health service gap. SCMC and SCDC earned trust with these community members over the years of serving the community, which would serve as a catalyst for effective intervention dissemination. Studies in resource-strained settings found the training of lay mental health workers to improve their knowledge, skills, and confidence in delivering mental health services a feasible approach to address mental health needs (Deimling Johns et al., 2018; Pallikkuth et al., 2021). Additionally, policy level changes are needed to continue to reduce the challenges for PWH by reducing medication cost, increasing free CD4 and viral load testing, and including more ART medications into the government-paid regime options. HIV stigma at the structural level could be addressed by establishing legal protection for PWH from employment discrimination, public education of HIV, and intervention to reduce HIV-related stigma among healthcare providers.

Limitations

This study has several limitations. First, due to the convenient sampling method, individuals who volunteered to participate in this study were likely to have relatively high interest in mental health, high trust in the CBO and researchers, low avoidance, and social withdrawal tendency. A few participants met the inclusion criteria but were not able to participate in the interview due to privacy concerns or severe depressive symptoms. Continuing collaboration with SCMC and integrating more research activities in SCMC services might help researchers to gain more trust from HIV+ MSM community. Interventions that aim to target PWH with severe mental health issues should use targeted recruitment to reach those most in need. Second, the interviews were conducted over two years, from April 2020 to May 2022, during which time COVID pandemic caused additional stress for participants. We recognize that the context of the pandemic might

have made the coping process more difficult for our study participants. Nevertheless, given that this study aimed to examine the emotional distress and coping due to HIV positive diagnosis, we did not discuss the impact of COVID on individuals' coping process in detail. Despite the aforementioned limitations, results from this study could inform the development of multi-level interventions for MSM recently diagnosed with HIV.

Conclusions

Stress and coping is a social process that is better captured from a socio-ecological lens, especially in the collective Chinese culture. Receiving a positive HIV diagnosis leads to multi-level stressors that trigger individuals' coping efforts. Environmental factors from multiple levels interacted and compounded the stress as individuals adjusted to living with HIV. Individuals coping strategies were limited and could benefit from learning skills to cope with extreme and persistent emotional distress. Mental health support at community level was lacking. Multi-level interventions are needed to integrate mental health services into the HIV care continuum to enhance individual coping skills and build community mental health capacity.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Tables and Figures

Table 1. Interview Questions

1. Tell me about the process of getting the diagnosis. How did you feel the moment you received the positive diagnosis? How did you contract HIV? Who informed you? How did they inform you? How did you react? How did that make you feel?
2. How has HIV impacted your life, especially in the first few months of receiving the diagnosis? How was your mood and emotional status overall? What did you do to feel better? How did it work out (helpful or not helpful)?
3. Describe problems or difficult situations related to HIV. Tell me how you approached it, what happened next, what was the outcome? How did you feel about the outcome?
4. What support have you received from Shanghai Xinsheng (SCMC)? What support did you not get but would like to have?
5. Looking back, is there anything that you wish you had done differently to deal with the situation better?

Table 2. Analysis Steps

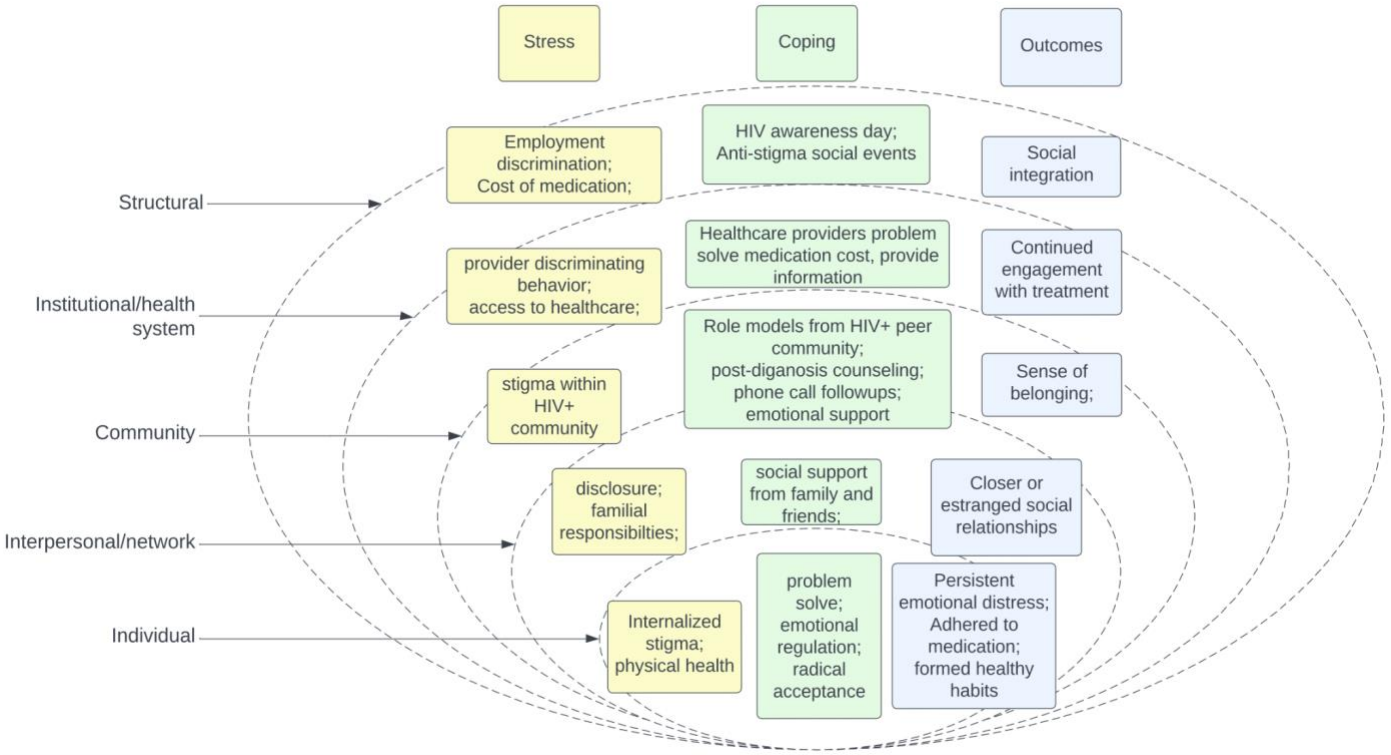
Approach	Steps	Details
Deductive	Develop categorization matrix	Main categories and subcategories were identified from stress and coping framework and socio-ecological framework and formed a categorization matrix.
Inductive	Consensus/Open coding	Data were coded based on complete ideas. In this stage, codes were generated by reading through two transcripts. Categories were freely generated, with the main categories in mind: stress, coping, outcome.
Inductive	Coding sheets/Grouping and categorization	The codes and categories were collected and organized in a spreadsheet and compared with the categorization matrix derived from the theoretical framework.
Deductive + inductive	Adjust structural analysis matrix	The categorization matrix was modified to take in the codes and categories generated from the data and formed a codebook.
Inductive	Independent coding	The first and second author coded the rest of the transcripts using the codebook.
Deductive + inductive	Corroborating and legitimating code and categories	The first author examined the categories, sub-categories, and codes to ensure that the codebook represents the data accusatively.

Table 3. Participants Demographics

	MSM living with HIV (N = 15)	SCMC staff (N = 5)
Age		
Mean (SD)	32.53 (8.73)	38.2 (5.12)
Range	21 - 55	30 - 44
Sex		
Male	15 (100%)	5 (100%)
Female	0	0
HIV duration (Months)		
Mean (SD)	9.0 (9.02)	NA
Range	2 - 35	NA
Work Duration (Years)		
Mean (SD)	NA	7.2 (4.1)
Range	NA	3 - 13
Ethnicity		
Han	15 (100.0%)	5 (100.0%)
Education		
Primary School or Below		
Middle School	1 (6.7%)	0 (0%)
High School	0 (0%)	0 (0%)
Professional School	2 (13.3%)	1 (20%)
College	11 (73.3%)	4 (80%)
Graduate or above	1 (6.7%)	0 (0%)
Monthly income (RMB)		

<2000	2 (13.3%)	0 (0%)
2000~4999	3 (20.0%)	2 (40%)
5000~7999	3 (20.0%)	1 (20%)
≥8000	7 (46.7%)	2 (40%)
Employment		
Yes	13 (86.7%)	5 (100%)
No	2 (13.3%)	
Local Hukou		
Yes	5 (33.3%)	3 (60%)
No	10 (66.7%)	2 (40%)
Local Permit		
Yes	10 (66.7%)	1 (50%)
No		1 (50%)
NA	5 (33.3%)	0
Sexual orientation		
Gay	15 (100.0%)	15 (100.0%)
Marital Status		
Unmarried & Single	8 (53.3%)	3 (60%)
Unmarried & partnered	5 (33.3%)	2 (40%)
Married	2 (13.3%)	0
PHQ 9		
None to minimal	4 (26.7%)	
Mild	9 (60%)	
Moderate	2 (13.3%)	

Figure 1. Multilevel stress and coping process: Stress and coping embedded in the socio-ecological framework.



Chapter 2. Improve Mental Health and Medication Adherence among Men Who Have Sex with Men Recently Diagnosed with HIV in China: Systematic Development of a Dialectical Behavior Therapy-Based mHealth Intervention

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Abstract

Background: Incorporating behavioral health theories into intervention development strengthens the effectiveness of these interventions. For mHealth intervention development, it is crucial to include additional theories that specifically guide the technological delivery aspect. However, a limited number of mHealth intervention studies have clearly outlined the theoretical foundations for both intervention content development and technological delivery. This absence of a robust theoretical basis may negatively influence intervention efficacy and present challenges when evaluating the effectiveness of individual components and any necessary intervention adaptations.

Objective: The objective of this study was to systematically describe the development of an mHealth intervention for men who have sex with men (MSM) recently diagnosed with HIV in China, including the theoretical basis for the content and the considerations for its technological delivery.

Methods: We used intervention mapping to guide overall intervention development, behavioral intervention technology model for technological delivery design, and human-centered design and cultural adaptation model for intervention tailoring throughout all steps of intervention mapping.

Results: The mHealth intervention, *Turning to Sunshine,* consisted of three components: individual skills learning through a mobile application, skills learning group, and on-demand phone coaching. The theoretical basis of the intervention content is based on the Dialectical Behavior Therapy (DBT) model of emotions, which fits our conceptualization of intervention user's mental health needs. The intervention aims to help MSM recently diagnosed with HIV to 1) Survive moments of high emotional intensity and strong action urges; 2) Change emotional

expression to regulate emotions; and 3) reduce emotional vulnerability and to help the community capacity around providing mental health support. Technological delivery considerations included rationale of the medium, complexity, and aesthetics of the information delivery, data logs, data visualization, notifications, and passive data collection.

Conclusions: This study laid out the steps of the development of an mHealth intervention, *Turning to Sunshine,* that aims to improve mental health outcomes for MSM newly diagnosed with HIV in China. The intervention mapping framework informed by human-centered design principles and cultural adaptation considerations offered a systematic approach to develop the current intervention and tailor it to the target intervention users. The behavioral intervention technology model facilitated the translation of behavioral intervention strategies into technological delivery components. The systematic development and reporting of the current intervention can serve as a guide for similar intervention studies. The content of the current intervention could be adapted to a broader population with similar emotional struggles to improve their mental health outcomes.

Keywords

Intervention mapping; participatory approach; cultural adaptation; Dialectical Behavior Therapy (DBT); Men Who Have Sex with Men (MSM); coping skill training

Introduction

Health behavior theories and models play an important role in guiding the development of behavioral health interventions. (Riley et al., 2011) Theory-based behavioral interventions overall are more effective in leading to behavioral change compared to those without theoretical basis. (Lycett et al., 2018) Additionally, effectiveness of theory-based interventions can be further enhanced through using evidence-based behavior change techniques that are supported by the literature. (Michie et al., 2013) However, the links between theory, behavior change techniques, and intervention design are often not reported in detail. (Lau et al., 2022) The lack of any detailed rationale for intervention components limits our ability to analyze the active ingredients of interventions, improve future intervention design, and adapt intervention programs for a different group of intervention users or cultural context. Intervention mapping (IM) offers an overarching framework for systematic development and reporting of behavioral health interventions. The IM framework outlines six steps of developing an intervention, starting from the logic model of the problem to an evaluation plan of the intervention. It is based on needs assessment to understand the target intervention users while taking into account behavior change theories to guide behavior change methods and practical strategies.(Bartholomew et al., 2006) The framework has an innate flexibility to incorporate theories, approaches, and empirical evidence that contribute to the overall intervention goals.

Behavioral health interventions delivered on mobile platforms (mHealth) such as mobile apps have the advantage of higher accessibility and potential for scalability, with flexibility to be used independently or adjunct to other health services. (Wang et al., 2020) In addition to the theoretical basis and evidence-supported behavior change techniques of the intervention content, the effectiveness of mHealth interventions also hinges on careful consideration of the mode of

delivery. (Webb et al., 2010) The technological delivery of behavioral health interventions goes beyond digitalizing the content of a psychosocial intervention. It requires careful consideration of the technical implementation of design components to software functionality to help the user reach their behavioral change goals. (Webb et al., 2010) The behavioral intervention technology (BIT) model proposed by Mohr et al. (Mohr et al., 2014) filled this critical gap in mHealth research by outlining the technological considerations (e.g., elements, characteristics, workflow) to guide the development of an architecture that fits the users needs, capabilities, and preferences. For example, the medium of information delivery should be carefully chosen to maximize intervention effect, taking into account the fit between a medium type and the users. Text format allows the user to control their speed of processing the information while the complexity limits it to more educated users. (Palvia et al., 2011) Notification messages can serve as reminders for users to engage in certain activities (e.g., exercise). Visualization of mood in a line chart may increase users' awareness of their emotions, which is the first step towards using emotion regulation skills early and effectively. A persuasive system design utilizes primary task support (e.g., simplifying complex behaviors, self-monitoring); dialogue support (e.g, positive reinforcement); credibility; and social networking components to assist behavior change, maintenance, and adherence to the mHealth intervention. (Kelders et al., 2012) However, the literature on mHealth behavioral interventions mostly focuses on the content of the behavioral change intervention, without description of the rationale behind the technical delivery of the content. (Mohr et al., 2013; Riley et al., 2011)

Tailoring and adaptation of behavior change techniques and delivery to the target population is a critical step in the development of mHealth interventions. A community-engaged research approach harnesses the expertise of the community stakeholders and emphasizes mutual learning

and shared decision-making between community and academic researchers. In health disparity research, this approach enables researchers to gain a more informed understanding of the determinants of health at individual and contextual levels.(Rhodes et al., 2018) In digital health research, human-centered design (HCD) principles prioritizes the user experience when interacting with a digital system, with the aim of creating effective, efficient, engaging products that are easy to learn. The creation of such products is grounded in in-depth understanding of the user and the context using methods such as co-design sessions, usability tests, and rapid prototype and interactive development. (Courage & Baxter, 2005) With its unique focus on user experience, HCD principles and methods are increasingly applied to tailor psychosocial interventions to the intervention users to create useful, usable, valuable, and desirable, credible and accessible intervention programs.

Contextual factors need to be considered early on in the formative stage of intervention development to inform adaptation and tailoring to the target population. (O'Hara et al., 2022) The field of mental health interventions increasingly realizes the importance of culturally responsive interventions. (Rathod et al., 2018) Culturally adapted interventions were more effective in improving mental health outcomes among Black and ethnically diverse individuals compared to unadapted active interventions.(Arundell et al., 2021) According to the ecological validity framework (EVF), cultural adaptations of mental health interventions include the following dimensions: language, persons assisting intervention delivery, metaphors, content, concepts, client goals, and behavior change methods.

The primary goal of this study was to describe the development of a novel mHealth intervention for men who have sex with men (MSM) recently diagnosed with HIV in China, with an emphasis on its systematic development.

Methods

Below, we illustrate 1) the steps of IM that guided the development of the current intervention; 2) the design of technological features for delivery components using the behavioral intervention technology model; (Mohr et al., 2014) 3) how content and delivery were tailored using human-centered design principles, cultural adaptation of evidence-based psychotherapy, and community-based participatory approach,.

Intervention Development Using Intervention Mapping

The intervention development followed the steps outlined in the IM protocol, including, 1) conducting a needs assessment, 2) determining intervention goals and objectives, 3) selecting intervention and behavioral change methods, and 4) designing and developing program materials (Bartholomew et al., 2006). An intervention matrix was developed based on step 2, to represent overall program goals (i.e., the results the intervention intends to achieve); performance objectives (i.e., actual behaviors of each intervention user needs to perform to achieve the results); and change objectives (i.e., the behavior determinants that need to change for the intervention user to perform the desired behaviors). In the intervention matrix, the performance objectives in each row intersected with the behavior determinants in each column to generate change objectives in each cell. The performance objectives were selected based on needs assessment results and relevant theory (i.e., Dialectical Behavior Therapy (DBT) model of emotion). The selection of behavioral determinants was guided by the model of behavior (COM-B) and behavior change models (Behavior Change Wheel), as well as relevance of the constructs to the current study.(Michie et al., 2011) The intervention matrix outlined the logic model of change and represented active ingredients of the intervention program.

Technological Delivery Using BIT

The behavioral intervention technology model aims to facilitate the design of technological features that facilitate and maximize the behavior intervention impact. This framework integrates theoretical why (i.e. aims and goals of intervention) and how (i.e., conceptual behavior change strategies) with technological what (i.e., technological elements), how (i.e., medium and aesthetics), and when (i.eworkflow). This study uses the BIT framework to promote the synergistic relationship between intervention content, delivery methods, and technological design. Integration of IM and BIT in this study aims to translate the intervention objectives and strategies into app features or guide design considerations of the digital delivery platform.

Intervention tailoring

HCD Principles and Strategies

User-centered design (HCD) places users' needs and preferences at the center of attention when designing a service or product, drawing from human-computer interaction, service design, and cognitive psychology. Other important HCD principles include 1) involving users in the design process and critical design decision-making, 2) aligning the product to users' needs, and 3) incorporating user feedback in the design -prototyping iterative process to improve user experience gradually. (Dopp et al., 2019) The general goal of applying HCD principles is to generate products that fit individual needs and preferences and contextual constraints to optimize effectiveness and efficiency in helping the user to accomplish a particular goal in a satisfactory manner.(Lyon & Koerner, 2016) HCD principles have been applied to improve user experience with software and physical products and to optimize healthcare service delivery. (Hekler et al., 2016; Lyon & Lewis, 2016) Recognizing its potential in improving the development and

implementation of psychosocial interventions, researchers have identified the HCD strategies to use when translating behavioral health research and evidence-based practices (e.g., evidence-based psychotherapy) to health services across different settings. (Dopp et al., 2019; Kruzan et al., 2021)

For the purpose of this project, we employed the following HCD strategies to tailor our intervention strategies to users. See **Table 1** for the strategies and applications in this study. Specifically, we used co-design sessions (N = 10) and usability testing (N = 10) to tailor intervention and iteratively re-design the intervention. Co-design sessions were conducted fully online and used MURAL and BoardMix to facilitate live collaboration. Each co-design session included the two research team members and two study participants. One researcher led the co-design session while the other asked follow-up questions and took notes when needed. Co-design sessions were designed based on the results from needs assessments and included two sections: (1) content design to further prompt potential users for their experience of emotional struggles and commonly used coping strategies post HIV-diagnosis and (2) delivery design to generate ideas for potential intervention or service that could facilitate coping. Usability sessions involved a think-aloud method to examine the overall ease of use of the main app features (e.g., medication and mood tracking) and aesthetics (e.g., color palette).

This article focuses on reporting the intervention development rationale. The specific results from co-design and usability testing are mentioned when relevant to the intervention rationale. The detailed procedure and results of co-design and usability testing sessions will be published separately.

Cultural Adaptation

Cultural adaptation of evidence-based treatment or intervention refers to modifications of the protocol to improve the compatibility of the treatment or intervention with individuals' cultural background, which includes but is not limited to cultural values, practices, beliefs, and preferences.(Haft et al., 2022) The ecological validity framework (EVF) offers practical guidance by outlining the eight dimensions to consider in cultural adaptation of evidence-based treatment or interventions, including language, persons, metaphors, content, concepts, goals, methods, and context. (Bernal et al., 2009)

Adaptation of evidence-based psychotherapy techniques considers therapist characteristics (e.g., ethnicity, language); therapeutic elements (e.g., culturally sensitive materials); and delivery setting (location and method of access).(Arundell et al., 2021) Most psychosocial interventions and evidence-based psychotherapies were developed and tested in a context characterized by the following features: western, educated, industrialized, rich, democratic. (Henrich et al., 2010) Thus, the content and approaches might not be culturally responsive for individuals with diverse racial and ethnic backgrounds. Although psychotherapy is idiographic/tailored to the individual in nature, the therapeutic elements such as culturally relevant metaphors could either greatly facilitate or impede therapeutic process. (Haft et al., 2022)

Community-based participatory approach

This work was guided by community stakeholders and expert consultation. The first author, a predoctoral trainee in clinical psychology, led the intervention development with extensive engagement with community partners and consultation with content experts. We established partnerships with Shanghai Municipal Centers for Disease Control and Prevention (SCDC) and

Shanghai CSW&MSM Center (SCMC) to gain a deeper understanding of the community's needs and priorities. SCDC and SCMC collaboratively provide services such as post-diagnosis consultation, in-person gatherings, and phone call follow-ups to assist individuals in transitioning to living with HIV. The researchers relied on input from community partners in project planning, conceptualization, data collection, and manuscript preparation. One SCDC staff and one SCMC staff were consulted through bi-weekly meetings throughout the study period to seek feedback and make timely adjustments to study protocol. Intervention content outline was first presented to our SCDC and SCMC partners, after which SCMC staff (N = 6) were gathered together for a feedback session after the intervention content was created.

Results

We describe the development of the current mHealth intervention following the four steps outlined in the IM framework, including 1) conducting a needs assessment, 2) determining intervention goals and objectives, 3) selecting intervention and behavioral change methods, and 4) designing and developing program materials. The results at each IM step also incorporated insights obtained from HCD principles and cultural adaptation dimensions to demonstrate the rationale behind intervention tailoring. In IM step 4, the BIT model was presented to describe the technological delivery of the intervention.

Step 1: Needs assessment

Mental health difficulties were more prevalent among people living with HIV compared to the general population. MSM in China are disproportionately affected by HIV and more vulnerable to mental health struggles due to minority stress and HIV-related stigma. We conducted a stakeholder interview of MSM living with HIV, SCDC and SCMC staff to assess the stress

following a HIV diagnosis, individual coping process, and community resources (Wang et al., n.d.). We used the stress and coping theory and socio-ecological framework to guide the interviews and qualitative data analysis. We found that stress from multiple sociological levels interacted with each other and produced compounded effects on the psychological struggles among MSM living with HIV.

MSM living with HIV reported being overwhelmed by the emotional turbulence upon receiving a positive diagnosis. They reported prolonged distressing HIV-related thoughts and emotions as they adjusted to living with HIV. However, these mental health needs were largely unmet and sometimes led to destructive and maladaptive behaviors (e.g., suicidal ideation, substance use) and prolonged suffering (e.g., depression and anxiety). Individuals lack the skills to regulate distressing emotions and thoughts and heavily relied on close relationships. Those who did not have support from friends or family mainly used self-help books and mental health apps (e.g. Headspace) to relieve their emotional pain. Individuals reported a lack of mental health support from the community organization. Services at SCMC and SCDC provided focus on linkage and engagement with HIV-related care. The staff provided occasional check-ins and organized peer support groups, but felt ill-equipped to provide appropriate mental health services. Both MSM living with HIV and staff at SCDC and SCMC recognized the mental health needs and the service gap.

Based on the needs assessment results, implications for multiple-level intervention development were reported in Wang et al. (under review), including1) individual coping skill training around emotional difficulties (initial high intensity emotions and chronic emotional distress) to improve mental health outcomes; 2) peer or lay provider training to increase community resources and

support around mental health; 3) leveraging role-model to reduce internalized HIV-related stigma; and 4) disclosure interventions to increase friends and family support.

Step 2: Intervention goals and objectives

Intervention goals were determined by the results from needs assessment. Intervention objectives were then specified using relevant theories and informed by the co-design sessions.

Overall program goals

The program goals were listed in the first column in Table 2. Informed by the needs assessment results, the first overall goal of the intervention program is to target MSM recently diagnosed with HIV to enhance overall mental health. Another goal of this program is to promote community and structural mental health support. MSM newly diagnosed with HIV face double stigma which causes them to isolate and not seek help. SCMC staff are usually the first point of contact for MSM newly diagnosed with HIV which places them at a unique position to provide first-aid emotional support. SCMC staff could also provide long-term emotional support through incorporating mental health check ins into their current follow-up calls that are focused on medication adherence.

Performance objectives

Performance objective refers to the behaviors each intervention user needs to perform to reach the overall program goal. We modified this definition to incorporate the community organization, given the existing service structure and the importance of community support to MSM recently diagnosed with HIV. The results from needs assessment, the DBT model of

emotions, and co-design sessions, informed the identification of performance objectives (Table 1).

The needs assessment revealed the emotional struggles among MSM living with HIV, with intense emotions immediately after diagnosis and chronic emotional distress. Figure 1 presented the emotional difficulties reported by MSM living with HIV. The initial unbearable emotional suffering led to extreme thoughts and urges, such as suicidal ideation and attempts among several participants. The chronic emotional difficulties impaired social functioning and led to avoidance of daily activities such as work and socializing. Emotion dysregulation is a risk factor for developing mental health problems, through interaction with impulse control and interpersonal difficulties (M. Linehan, 2014).

Recognizing the difficulties around coping with emotions and its implications on long-term mental health, we decided to use the DBT model of emotions to guide our understanding of emotions and identify behaviors individuals can perform to address emotion regulation difficulties (i.e., performance objectives). The DBT model of emotions offers a framework to understand emotional responses and outlines concrete skills to regulate emotions to reduce risk of developing mental health problems, decrease its negative consequences, and improve global functioning (M. Linehan, 2014; M. M. Linehan, 2014) .

According to the DBT model of emotions, emotional responses are systemic responses that include the following subsystems: 1) emotional vulnerability; 2) prompting events (i.e., internal or external events as emotional cues); 3) interpretation of the prompting events; 4) biological changes and experience of emotions (e.g., action urges); 5) verbal and nonverbal expression of emotions; 6) after effects of emotional response (e.g., secondary emotions). The subsystems are

interactive so that the overall emotional response can be modified by changing one or more of the components of the system.

The co-design sessions further revealed that the number of coping strategies for high emotional intensity situations (N = 19) was smaller compared to strategies for lower emotional intensity (N = 26). In addition, substance use such as smoking and drinking alcohol emerged as a coping strategy especially for situations with high emotional intensity. For example, in one of the PD sessions, both participants mentioned that they drank when they felt overwhelmed by high-intensity emotion. Regardless of the emotional intensity levels, the most commonly used strategies used by participants were distraction (e.g., keeping busy with work or other activities); talking with trusted friends or family; problem solving; and exercise. Spending time alone was the most frequently mentioned coping strategy when they felt overwhelmed by emotions. In sum, the co-design sessions suggested limited skills around emotion regulation, especially skill deficit in coping with high emotional arousal.

Based on these results, we selected three components from the DBT model of emotion to derive performance objectives:1) biological changes and experience of emotions (e.g., action urges); 2) verbal and nonverbal expression of emotions, and 3) emotional vulnerability, given its broad implications to other subsystems. Figure 1 presented performance objectives mapped onto difficult emotions uncovered from needs assessment sessions. The performance objectives are as follows:

1) *Survive moments of high emotional intensity and strong action urges*

Emotions are accompanied by biological changes and action urges. For example, fear is often associated with activation of the sympathetic nervous system, which increases our heart rate,

leads to sweating, enlarges the size of our pupils, and leads to the action urge to fight or flight. In a crisis situation such as the moment of receiving the positive diagnosis, emotional intensity is high and the emotional pain can be overwhelming. The related performance objective is to survive the crisis, tolerate the pain and distress without acting on destructive urges (e.g., suicide).

2) *Change emotional expression to regulate emotions*

Emotional expression includes facial, body language, and behaviors. For example, sadness is often expressed with eyes dropping, not smiling, sobbing, and a quiet and monotonous voice. Changing emotional expression can lead to changes in emotions as well. When the emotional intensity is not as extreme, such as the emotion associated with taking medication everyday reminds individuals of their diagnosis, effective use of emotion regulation skills can help receive emotional pain. The related performance objective is to change emotional expressions to regulate emotions (M. Linehan, 2014).

3) *Reduce emotional vulnerability*

The vulnerability factors increase individuals' sensitivity to a promoting event, may lead to biased interpretations of the event, and may increase the intensity of biological reaction and expression. The vulnerability factors may include lack of sleep, hunger, influence of substances (e.g., alcohol, mood altering drugs), or a series of negative life events. When these vulnerability factors are modified, the emotional response and/or the intensity of that response can change. Thus, the related performance objective is to reduce overall emotional vulnerability.

Regarding the program goal of promoting community and structural mental health support, the performance objective is to create a structured environment to support individuals' learning. The learning of behavioral skills is especially challenging when the person does not receive

reinforcement from a supportive environment that reinforces such learning (M. Linehan, 2014). In mHealth interventions, periodic human support in general improves adherence to mHealth tools and is linked to better outcomes. Supportive accountability is a mechanism that contributes to the coaching effect, by providing assistance in clarifying goals, monitoring, and review of progress (Mohr et al., 2011). Therefore, the performance objective at the structural level is to complement the individual skills learning with community services (e.g., skills training group) informed by guidelines and principles of the DBT skills group.

In summary, to reach the overall program goal, the individual and community level performance objectives need to be attained, as listed in the second column of Table 2.

Step 3: Intervention and behavioral change methods

We determined the change objectives of the intervention program based on the performance objectives above and the behavior determinants based on the COM-B model of behavior, including capability, motivation, and opportunity. (Michie et al., 2011) See Table 3 for the components of COM-B, definitions, and intervention functions applied to this study.

The COM-B connects the model of behavior directly with intervention functions that can target one or more behavioral determinants through the Behavior Change Wheel (Michie et al., 2011). Thus, the COM-B model combined with BCW offers an efficient method to determine intervention functions based on behavioral targets. Additionally, contextual factors are inherent components of this framework, reflected in the physical and social opportunity. Given the dependence on community resources of MSM recently diagnosed with HIV, contextual intervention is especially appropriate to induce and maintain behavior change to reach the program performance objectives. The automatic processing element within the motivation

component of the COM-B system aligns well with the findings from needs assessment, which indicates the benefits of peer role models on coping with internalized stigma and generating hope (Wang et al., under review).

Selecting appropriate intervention functions to fit the characteristics of the target population and contextual features could optimize the effectiveness of the intervention (Olander et al., 2013; Peters et al., 2015). Thus, we selected four most relevant and feasible intervention functions that target all three components in the COM-B model of behavior (Table 3).

1) Education: knowledge and understanding of emotion can increase the psychological capability and the rationale behind and benefits of emotion regulation can enhance the reflective motivation for the participants to learn skills;
2) Training: learning and practicing cognitive and behavioral skills both individually and in a group setting can facilitate participants to gain the psychological capability;
3) Enablement: skills group and SCMC phone coaching can guide the participants to select and practice appropriate skills, especially in a situation with high emotional arousal; additionally, staff and app-assisted goal setting, monitoring, and timely feedback are also reinforcers of behavior change;
4) Modeling: the skills group training environment provides ample opportunities for imitative learning and role modeling.

In summary, the intervention will use education, skills training, enablement, and modeling to target the capability, motivation, and opportunity of behaviors to reach the performance goals described in the previous step (Table 2).

Step 4: Design and development of program materials

The intervention program includes three components: individual skill learning using the mobile app supported by a skills group and on-demand phone coaching. This overall program design is informed by results from co-design sessions and the elements of DBT treatment programs.

The rationale for each intervention component is as follows:

1) Individual skills learning: emotion regulation and coping skills were highlighted by the participants regarding the content of the program they'd like to receive. They preferred the content to be tailored to the needs of the HIV-positive community. They emphasized that the content needs to have credibility while using language that could be easily understood by a general public without much mental health background. Each individual skills learning module is followed by a quiz to reinforce learning and increase engagement.
2) Online skills training group facilitated by SCMC staff: skills training group was perceived by participants as efficient in providing low-intensity mental health support, where shared experience was perceived to increase their ability to empathize with one another. SCMC staff has established trusting relationships with the HIV-positive MSM and was perceived as trusted resources for HIV-related information. Online compared with in-person groups have the unique advantage of protecting participants' privacy.
3) On-demand phone coaching: 1-1.5 month was the length of the intervention program perceived as feasible, with 0.5-2hr each weekly session. Meanwhile, phone coaching was incorporated to meet higher needs for mental health support especially in the early stage post HIV diagnosis.

The cultural adaptation of the DBT skills was based on EVF including the following dimensions, language, persons, metaphors, content, concept, goals, method, and context (Haft et al., 2022). Take language adaptation for example, translation of certain DBT terms emphasized on conveying the meaning accurately rather than word-to-word translation. Radical acceptance DBT refers to complete acceptance of reality, was translated to 全然 (quan ran), rather than translated verbatim, 激进（*ji jin*), which means extreme. We also used culturally relevant metaphors, stories, and skill practice examples that resonate with HIV-positive individuals to design the intervention content. For examples of adaptations in other dimensions, see (Table 4).

Program behavioral skills delivery

Individual skills training

Based on the previous steps of intervention mapping and co-design sessions (see step 2-3), the content of individual skill learning includes the following modules and delivered in the form of podcasts: 1) Psychoeducation of emotions: the process of emotion response, types of emotions, emotional intensity, and functions of emotions; 2) How to increase tolerance of distress and get through a crisis situation; 3) How to accept reality and relieve emotional suffering; 4) How to regulate emotions through change behaviors and how to reduce overall emotional vulnerability; 5) Summary of all skills and highlight of takeaways.

Group-based skills training

In addition to using the app on their own, program users will attend a weekly skills group (3-5 group members) facilitated by trained SCMC staff. In the skills group, the topic of each skills group is the same as the content covered by the app in a given week. The skills group will have

an on-boarding meeting: 1) to orient the group members to the purpose of skills training, introducing the skill deficit model of emotional and behavioral dysregulation and outlining the content covered in this intervention; 2) to introduce the group format and guidelines, including the roles of the skill trainer (i.e. SCMC staff) and the group members; 3) for group members and SCMC staff to get to know each other; 4) for individual group members to share their personal goals through this intervention, including behaviors to decrease and skills to increase.

The skills training group structure was adapted from the standard DBT skills training. The weekly group lasts about 1.5 hr, and consists of the following components: 1) mindfulness practice (5-7 min); 2) summary of the skills covered by the app in the week prior to this session (5-10 min); 3) homework review (45 min); 5) preview of next week's content (5-10 min); 6) assign worksheet for next week and goal setting for next week (5 min).

The purpose of the skill group is to provide a supportive environment at the community level for the peers to learn and practice skills together through peer and SCMC staff modeling. The group members will take turns to share how they practiced the skills during the week and the rest of the group members and the SCMC staff will provide validation and constructive feedback. If the individual encounters any problems with applying the skills on their own, the group will help the individual problem solve and provide constructive feedback as needed. The norm of attending groups regularly and practicing skills between sessions established through the skills group can motivate people who conform to this norm and increase their probability of practicing skills between sessions. This allows group members to interact with people with similar struggles and the development of a validating and supporting environment is therapeutic to all members. Stickers will be given out to those who attend the skills group and practiced skills that week. (M. Linehan, 2014)

Adapted from the DBT skills training group guidelines, the skills group guidelines serve as a structure that outline a set of behaviors and principles that group members are expected to follow while in the skills group:

1) Participants in the skills training group support each other through preserving confidentiality, attending groups regularly, validating others, practicing skills in-between sessions, providing noncritical feedback, and opening to receive help from other group members or SCMC staff;
2) Participants need to call ahead of time to let the SCMC staff know if they are going to be late or miss a session;
3) Participants need to be aware of how dysfunctional behaviors such as self-injury and substance use is discussed in the group; given that others may be influenced to engage in these behaviors, the mention of these behaviors should be brief and the focus should be on skills practice or problem solving around the behavior;
4) To prevent interpersonal conflicts from complicating the group dynamic, participants can obtain contact information with other group members and form supportive peer relationships outside of the group after completing the study period.

Phone coaching

Additionally, the SCMC staff will be available for between-session skills coaching via call or texting to help participants identify and practice skills in difficult situations in daily life and get through crisis situations when emotional pain is intense and dysregulated behaviors may occur as a result. It is common for individuals to have difficulty asking for help. Some contributing factors may be: not being aware of the situations that they might need help, failing to ask for the

type of help they need, asking for help indirectly (e.g., hinting). Phone coaching enables the SCMC staff to cultivate individuals' ability to effectively ask for help and provide feedback and help problem solve with ineffective help-seeking skills. In DBT treatment programs, phone coaching is used to help clients generalize skills learned in therapy sessions.

The goals of phone coaching are:

1) Skills generalization
2) Validating participant's need for contact
3) Intervention on suicidal behavior: skills use, problem solve
4) Crisis coaching: shape them to context and use skills before problem behavior occurs.
5) Contingency management.

The general guidelines for phone coaching include:

1) Validate and reinforce skillful help-seeking behavior, such as clearly stating the situation, what they have tried, and what they need more help with;
2) Generally focus on how to use skills to prevent rather than manage a crisis when it occurs so that the frequency of phone coaching will reduce over time;
3) Keep the phone coaching session between 5 to 15 minutes and use directive communication style given the limited time;
4) Decrease crisis behaviors, increase skill generalization, and reinforce effective skill use.

Program technological delivery

We used the BIT model to guide the design and report of the technological delivery of the intervention, including elements, characteristics, and workflow.(Mohr et al., 2014) The elements refer to the technical aspects of implementing the intervention content and behavior change

strategies. The characteristics refer to the way elements are presented, including medium, complexity, aesthetics, and personalization. The decisions were informed by co-design sessions and industry standards. The elements and characteristic considerations and rationale are presented in the Table 5. Workflow refers to the user interactions with the app to receive the intervention.(Mohr et al., 2014) The mobile phone application was designed for users to interact over the one-month study period to access the content of the intervention. The conditions upon which elements of the intervention are delivered include time-based rules and task completion rules. New podcast content will be released at the start of every week. The users can decide when to access the intervention and can repeatedly listen to and review the content if needed, i.e. individual paced learning. The users need to complete listening to the podcast to access the quiz. The app content is delivered with a combination of hierarchical, tunneling, and matrix information architecture (Figure 2). The hierarchical design of the homepage presents all features and content of the app to the user in a top-down organization. Users will be taken through intervention modules following the tunneling design, where step-by-step flow helps users navigate through the modules. User has access to all the completed modules in a matrix design. The combination of these information architecture designs can achieve the following goals: 1) the hierarchical presentation of homepage is familiar to most users and provide a dashboard for all tasks and content; 2) the tunneling optimize the ordering of information delivery and thus intervention effectiveness and titrate the information presented to the user to reduce information anxiety; 3) the matrix design allow for flexibility of accessing content.(Danaher et al., 2005, 2015)

Discussion

This study illustrated the development of mHealth psychosocial intervention that combined individual skills learning via an app, group skills training, and phone coaching to improve mental health outcomes for MSM recently diagnosed with HIV in China. We used interdisciplinary theoretical frameworks and approaches, including behavioral science, clinical psychology, human-centered principles, and behavioral intervention technological delivery. Specifically, we used the steps outlined in the intervention mapping protocol to guide the conceptualization of program goals and overall steps of development. The DBT model of emotion, emotional regulation skill informed specification of performance objectives. The COM-B system of behavior and behavior change wheel further connects the performance objectives to intervention functions and strategies. While the theories above informed the conceptual specification (conceptual how) of the behavioral intervention, the BIT model guided the technological delivery (technological how) of this intervention. The user-centered principles and strategies as well as cultural adaptation considerations were applied throughout all steps of intervention development to tailor behavioral components and technological delivery to the community.

Complex decision-making is involved in all steps of intervention development that aims to solve a specific health problem. This study presented a detailed intervention rationale that outlines the theoretical reasoning and behavioral change mechanisms behind each intervention component. This is critical to the subsequent interpretation of study findings through analysis of active intervention ingredients. A thorough understanding of the effects of each intervention component will aid future efforts in adaptation and improvement of the intervention. In this study, we used the DBT model of emotion to understand the emotional difficulties and subsequent social and behavioral consequences revealed in the needs assessment stage. By mapping emotional

difficulties from low to high emotion intensity, we determined the subsystems of emotion to intervention as our performance objectives, including reducing high emotional arousal, changing emotional expression to regulate emotions, and reducing emotional vulnerability. To achieve these performance objectives, we selected education, skill training, enablement, and modeling as the key intervention functions to impact capability, motivation, and opportunity of behaviors, guided by COM-B systems of behavior change wheel. The DBT treatment model of individual skills training, skills group, and phone coaching, then informed the operationalization of behavioral change methods. Growing evidence supports the effectiveness of theory-based behavioral interventions.(Lycett et al., 2018) IM offers a framework to synthesize conceptual (e.g. DBT model of emotions; COM-B) and action theories (e.g., DBT emotion regulation model, behavior change wheel) to derive a logical chain of decisions that determines the causal links of treatment components and outcomes.(Bartholomew & Mullen, 2011)

In addition to theoretical considerations, this study also engaged community members and intervention users throughout development using user-centered design principles and strategies. The needs assessment with community members played an important role in determining the multi-level program objectives of this intervention, including individual skills training and community-level capacity building. Staff training is an inherent component of this intervention to prepare the SCMC staff to facilitate skills training groups. Intervention testing and long-term sustainability hinge on a set of contextual limitations. Therefore, it is especially important to involve both intervention users and community partners in decision making around intervention design to optimize feasibility, such as the length of intervention, the intensity of staff training, and organizational support for staff to participate in the intervention study. The co-design sessions prompted community members to generate solutions to emotional difficulties (e.g.,

come up with coping strategies regarding an emotional situation) and brainstorm services and interventions design (e.g., individual format vs. group format; online vs. in-person). This co-design process naturally incorporated the cultural adaptation considerations of DBT skills, including persons delivering skills training group, metaphors and examples used in skills training materials, the use of existing cultural idioms to communicate DBT concepts, the method of using groups to complement individual skills learning to reduce HIV and mental health-related stigma, and the use of staff-delivered phone coaching to enhance effective skill generalization. The design of behavioral elements of this intervention went through iterative rounds of design-development through community engagement and consultation with experts to ensure appropriate translation of clinical and behavioral science into user-centered and practical intervention strategies. Many interventions developed by academic researchers were mainly based on evidence from the literature and could benefit from end-user input early on in the formative stage. The cycle from development to an RCT trial for efficacy took years and more time is needed to translate to the effectiveness and implementation stage. A community-engaged and user-centered approach enables the research team to align their research goals with users' needs and conduct iterative and rapid revisions to increase the contextual appropriateness, acceptability, and feasibility of the intervention and thus may significantly shorten the cycle from development to implementation and bring meaningful social impact faster. Application of multiple frameworks such as MOST and DDBT synthesized the iterative nature of HCD principles and implementation forward approach to develop effective and scalable health interventions with rigor and efficiency.(O'Hara et al., 2022)

This study used the BIT model to strive towards the synergistic effect between behavioral intervention content and technological delivery. Even with evidence-based behavioral change

strategies and coping skills, the effectiveness hinges on operational factors such as the characteristics of the persons delivering it. We addressed this by providing training for SCMC staff who will facilitate the skills training groups as part of the intervention. The technological delivery of intervention functions (e.g., education, training, enablement) were guided by the BIT model. The characteristics of each technological element (e.g., medium, complexity) were carefully determined based on design theories and standard practices to optimize the usability of the digital platform and create engaging and pleasant user experience.(Mohr et al., 2014) The combination of behavioral intervention and technological delivery provide a convenient and easily accessible way to engage users and encourage adherence to the intervention. Additionally, the user data collection provides valuable information on real-time user engagement with app content and the frequency of using a certain feature. For example, how long a user stays on a page or how frequently a user visits a page may indicate their interest level or needs for a specific content. Such information allows future personalization of the app to tailor towards the user's preference and learning goals. User activity data can also be used to interpret intervention outcome by isolating user engagement and adherence to the intervention as a contributing factor towards the intervention outcome.

Limitations

There are several limitations of the current work. First, the needs assessment stage collected qualitative data and would benefit from quantitative survey data to evaluate the community service gap in mental health services and staff attitudes towards mental health training to provide such services. First, personalization is still lacking in the current version of the mHealth app that delivered the individual skills training component. The user is able to mark their favorite coping skills for further reference, but the functionality of recommending similar skills to the user based

on the user-reported problem situation is yet to be developed. Given the highly contextual nature of coping skill use, further version of this app aims to use computational models to account for the dynamic interaction between individual behavioral change progress and situational factors. Second, this study used co-design sessions as a user-centered design strategy to engage end users in designing the intervention. At the same time, the extent of user engagement in our study fell on the lower end of the participatory design spectrum, especially regarding the intervention delivery design. Approaches such as using a user journey map can engage end-users in actively conceptualizing the overall intervention program. Nevertheless, the limited familiarity of mental health services of the participants in this study might explain the challenges in eliciting ideas around mental health service delivery. Third, our ability to engage the community in a co-design session might be hindered by the limited interactions that can occur within a brief timeframe. Further iterations of intervention design and improvement could adopt a longer participatory design process by following up the participants over several months to build rapport with participants and understand their needs. For example, users can participate in the cultural adaptation of DBT based skills by co-creating invention materials such as culturally-informed metaphors. Additionally, the co-design session structure changed over the progress–although the overall goals and questions we asked are about the same, the way we asked questions, structured the sessions, and presented the content might have influenced participants' thinking and their answers. For example, after realizing the participants had difficulty distinguishing coping strategies for low and high intensity emotions, we started the co-design session asking participants to rank emotion and intensity before asking them to generate coping strategies. Finally, our usability testing collected feedback from users that generated valuable design insights. We were not able to implement every design solution in the current version of the app

due to the timeline constraints. However, we implemented changes that were important to user experience and effective delivery of our intervention content in the current version of the app.

Conclusions

We designed an mHealth intervention that aims to improve mental health outcomes for MSM recently diagnosed with HIV in China with a systematic approach that may serve as a blueprint for future interventions. The detailed layout of development steps will aid the causal analysis of the intervention effect. The content of the intervention can also be easily adapted to a broader group with similar acute and chronic emotional struggles. The intervention mapping framework informed by user-centered design principles and cultural adaptation considerations offered a systematic approach to develop and tailor the current intervention. While the DBT model of emotion, COM-B system of behavior, and behavior change wheel informed the conceptual mechanism of the behavioral intervention, the BIT model facilitated the translation of behavioral intervention strategies into technological delivery components, i.e., the technological mechanism. Future research, currently underway, will pilot test the intervention to gauge acceptability, feasibility, and ultimately efficacy and effectiveness.

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Conflicts of Interest

Authors declare no competing interests.

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Tables and Figures

Table 1. UCD strategies, definitions, application in this study

UCD strategies	Definition	Application in this study
Formative evaluation		
Interviews	Use individual interviews with potential users to collect information regarding user preferences, experiences, and priorities.	Interviews with MSM living with HIV, SCMC staff, CDC staff, to identify mental health needs and service gaps.
Define target users and their needs	Identify and develop a list of target problems based on the input from those who are affected by the problem	Define psychological difficulties after receiving HIV-diagnosis, their coping process, and the unmet mental health needs.
Design-focused techniques		
Co-design sessions	Designers, potential users, stakeholders collaboratively design an intervention prototype.	MSM living with HIV, therapist, SCMC, and CDC staff meet to design and tailor the content and delivery of the coping skills intervention.
Passive storyboards	End users are first presented with scenarios and prompted for how they would navigate the scenario.	MSM living with HIV were presented with likely scenarios after receiving the diagnosis and asked about the strategies they used to cope with the emotions.
Use associative object-based techniques	Ask the users to sort, rank, or organize solutions to a problem or other constructs relevant to the intervention.	MSM living with HIV were asked to conceptually group coping strategies, match with intensity of emotions, and rank their importance and feasibility.
Parallel prototyping	Multiple design concepts were implemented and tested out to select the best solution.	Multiple designers designed a podcast page independently following a set of agreed-upon principles to diversify design solutions.
Engage in cycles of rapid prototyping and iterative development	Start with a simple prototype (wireframe) and use the prototype to obtain feedback from users and improve the design and development.	We used a wireframe app prototype to obtain a few rounds of feedback from stakeholders and iteratively improved and built a high-fidelity design.

Summative evaluation		
Think aloud exercises	The end users speak aloud when completing a task using the app.	The usability testing used this technique to understand user interaction with the app.
Interpretation sessions and present user reports with stakeholders	Summarize the results from interview and co-design sessions and present to stakeholders.	The results from needs assessment were presented to CDC and SCMC staff, and participants from needs assessment who also participated in the co-design sessions.

Table 2. The matrix of change objectives

Program Objectives	Performance Objectives	Intervention functions/theoretical behavior change methods		
		Education	Skill Training (DBT skills)	Enablement, Modeling
Mental health	Survive moments of high emotional intensity and strong action urges	Emotional intensity and impulsive behavior	How to get through a crisis and overwhelming emotions without making things worse?	Text or phone coaching by SCMC staff
	Change emotional expression to regulate emotions	What is emotion and functions of emotion	How to regulate emotions that are not effective given a certain goal?	Role model Peer support group Goal setting, monitoring, and feedback
	Reduce emotional vulnerability	What is emotional vulnerability and why it matters;	How to build emotional resilience and reduce vulnerability to the emotion mind?	Role model Peer support group Goal setting, monitoring, and feedback
Community capacity building	Promoting community and structural mental health support	DBT model of emotion; DBT skills;	Basic behavioral therapy techniques to reinforce skill learning; Phone coaching skills.	Group supervision

Table 3. Determine change objectives using links between components of COM-B model and intervention functions relevant to this study

Behavior determinants (COM-B)	Definition and example application in the current study	Intervention functions/Theoretical behavior change methods			
		Education	Training	Enablement	Modeling
Capability	Individual's psychological and physical capacity to perform a certain behavior. E.g. learning the necessary emotion regulation skills	✓	✓	✓	✓
Motivation	International processes that direct and induce behavior, including both conscious decision making (i.e., reflective motivation) and such as habitual process and emotion-driven behaviors (i.e., automatic motivation). E.g. gain motivation through observing successful application of coping skills of peers	✓	✓		✓
Opportunity	Non-individual factors that prompt or facilitate the desired behaviors, including physical and social opportunity.		✓	✓	✓

Table 4. Cultural adaptation domains and applications

Domain	Definition	Application in the current study
Language	Translate the language so that the intervention can be understood by the users.	DBT based skills content were all translated to Mandarin. Translations of certain DBT terms were adjusted to convey its original meaning rather than adopting a direct verbatim translation. For example, radical was translated to 全然, rather than 激进, to convey the complete acceptance of reality.
Persons	Who deliver the intervention	Staff members at SCMC received training to facilitate the skills group and provide phone coaching. SCMC staff have long-standing trusting relationships with the HIV positive MSM community, expertise in HIV-related treatment orientation, and can provide a

		stable point of contact for continued mental health support post HIV diagnosis.
Metaphors	Use metaphors that are close to the target culture to assist understanding.	We used a cultural idiom (“情绪决堤”) to describe how lack of emotional resilience and coping skills is like having lower dam so that whenever a negative event in life caused a wave the emotion will flood over the dam.
Content	Adjustment made to content to meet the specific cultural and intervention context.	The podcast was designed so that the content would resonate with the user, while not using terms such as HIV positive. For example, we use a terminal diagnosis of a family member as an example event to illustrate radical acceptance skills, which share some similarity with the coping process post HIV-diagnosis. This is to protect users’ privacy in the case that others happen to hear the content of this podcast. This can also reduce the potential barrier of shame and internalized stigma accessing these content.
Concept	Tailor the therapy relevant concepts to aid understanding in the given context.	We used “举杯消愁愁更愁” (drinking to reduce sadness only does the opposite), a line from a well-known poem, to express the concept of ineffective coping of negative mood using substance such as alcohol.
Goals	Align the goals of the intervention or treatment with the target users.	Based on the results from needs assessment, we define the main goal of the intervention to be providing skills to relieve emotional pain that might get in the way of them, adhere to HIV-related treatment, stay engaged with social life, and continue a life worth living.
Method	Adapt the format of the intervention to fit the context of delivery.	We decided to add the online skills group format to: 1) provide a peer-supported learning environment to cope with difficult emotions; 2) learn from peers’ successful coping stories and journey to reduce internalized stigma of HIV; 3) protect individuals’ privacy using online format.
Context	Consider the broader contextual constraints and factors that might hinder or facilitate intervention delivery.	We used the term “skills training class” and “skills training app” rather than terms related to mental health, considering the stigma and high sensitivity related to mental health conditions. Similarly, we did not use any terms that explicitly link the app content to HIV positive individuals considering the social impact accidental disclosure may have on individuals such as rejections from family and loss of employment.

Table 5. Technology delivery considerations

Elements[a]		Characteristics			
		Medium	**Complexity**	**Aesthetics**	**Personalization**
Information delivery	Each module consists of a 3-min mini-lecture and a 10-15 min mock therapy conversation between a therapist and a client around the topic for each module. At the end of the mock therapy, the mock therapist briefly summarizes the important takeaways from the session and leaves homework for the client. Additionally, the program user will complete a quiz (4-5 questions) after each module, to consolidate learning and enhance engagement with the intervention content.	We chose to use a combination of audio and text (content outline) to deliver the module content of coping skills. Specifically, each module will be published as a podcast accompanied with an outline of the podcast content. The **media richness theory** suggests that forms of media vary in their ability to convey different forms of information. The information delivered is most effective when the communication channel/media aligns well with the goal of intervention and user capabilities.[b] Based on the PD sessions, we chose audio format over video. Although both can effectively communicate the module content by presenting lecture and mock therapy conversations, audio format eliminates unnecessary visual distraction, creates space for users to freely follow the content outline, and is easily accessible when mobile data is limited (e.g. during transit). In the co-design session with participants, audio, video and images	We kept the complexity of the information relatively low in order to make it easily accessible to users of all educational backgrounds. Specifically, we used everyday language and carefully removed jargons in both didactic and mock therapy components. The mock therapy is also structured to make it easy to follow.	Color considerations: In regards to the consistency and accessibility of the design language, thorough consideration was given to both style and color. A thorough examination of various color schemes was conducted, ultimately leading to the determination that an analogous color scheme aligns with the theme of hope and support. In order to ensure legibility and comply with Adobe's Web Content Accessibility Guidelines, the colors pink and dark violet were chosen. Simplistic design: we simplified the features and user flow for less distraction and	The following aspects were considered, based on the cultural adaptation framework: language, persons, metaphors, content, concepts, goals, and methods.

		were perceived as more engaging than text only; although multiple delivery formats (audio and video) were perceived as more engaging, simplicity and ease of access was also highly valued.	The quiz is presented in multiple choice format so that users don't feel overwhelmed by text entry tasks.	interference, to reduce mistakes and confusion, and increase overall usability and accessibility.	
Logs, reports, and visualizations	Users track their medication taking using a calendar. Weekly mental health symptoms are tracked using a survey.	Data from medication and mental health logs will be presented to the user in the form of a bar graph and line chart on a weekly basis. Research suggests the tracking behavior can increase motivation for medication adherence. Building mental health awareness through tracking is the first step towards identifying places to use coping skills.	We designed the medication tracking feature with a minimal number of clicks required for users to mark their medication as taken. By automatically displaying a pop-up upon accessing the medication tracking page, users are able to quickly and easily mark their medication with a single click. To indicate which days the medication has been taken, we employed a simple color scheme with the theme color for taken medication and a blank space for	In our medication tracking visualization (bar graph), we employed a color-coding system using red (1-3 days/week), yellow (4-5 days/week), and green (6-7 days/week) to indicate different levels of medication tracking adherence. These colors were carefully selected by our design team to align with industry standards and convey the necessary information without appearing alarming to the user. Similar color-coding system was used to indicate the results of the user's depression tracking, based on their scores on the PHQ-9 questionnaire. The color spectrum used for this visualization ranges from red (severe) to	

			medication not taken. Incorporated a toggle switch that allows users to switch the status of medication taken on current or previous dates. Regarding data visualization, different charts to intuitively display the information and encourage users to be aware of their progress. We used a line chart to demonstrate the trend of mental health status and a bar graph to visualize the count data (number of days taken medication during a week) to emphasize the importance of taking medication on a daily basis.	dark green (non-minimal), with orange (moderately severe), yellow (moderate), and light green (mild) in between, providing users with an easy way to understand the level of depressive symptoms.	

Notifications	We use within-app notifications to prompt the user to listen to newly released podcast content, daily logs of medication, and weekly logs of mental health symptoms.	A colored dot on the app component indicating new content or incomplete tasks (e.g. medication and mood tracking). Notification messages are pushed to the user's wechat chat page for new podcast content and reminders for completing tasks (quiz).	The notification dot and messages have a low level of complexity. The dot only appears when there are unfinished tasks to remind the user to complete them. The messages sent to the user's WeChat will consist of a brief headline and a concise description of the content, so that the user is aware of the incoming information.	The color and size of the notification dot follows the guideline of WeChat notifications to reduce user's cognitive burden by maintaining consistency with industry standards.	

Passive data collection	We will collect user activity during app usage, such as frequency of clicking and listening to a podcast, complete rates of podcast, time spent on the quiz, click into the calendar page, mood tracking page, and visualization pages. How long a person stays or how often they visit a page might indicate their interest or their needs (or lack thereof) for a specific content or feature. The number of visitors of certain pages similarly reflects the importance of certain features or content. The aim is to assess user engagement with the intervention content and the tracking features of the app, for further iterations of app feature development and personalization of the app.	Statistics of number and location clicks, user data of listening length, and frequency and time spent in each page are collected and stored.	User's data are collected in the backend and visualized in appropriate graphs to indicate engagement with app features for researchers to uncover insights. For example, the number of visitors of each page within the app is visualized using a bar graph to reveal insights regarding the popularity of certain content. The number of daily visitors of the app is visualized using a line chart. The number of times a page or the app was shared by users can also be tracked.	The aesthetics of visualization of user activity data follows the WeChat UI guide. For example, all graphs use green as the main color, similar to most elements on WeChat. Red is used to indicate negative change (e.g. decrease in the number of visitors of a certain page) while gray is used to indicate no change.	These data are examined to give researchers information about how people are using the app, including any issues or errors that come up and what people are doing. For example, how long someone spends on a particular page might tell researchers whether that person was able to find a specific button easily or not. Additionally, how long a person stays or how often they visit a page might indicate their interest or their needs (or lack thereof) for a specific content or feature.

					The aim is to assess user engagement with the intervention content and the tracking features of the app, for further iterations of app feature development and personalization of the app.

[a] This app is embedded in Wechat, i.e.. WeChat mini-program. Thus, the overall design aesthetics need to follow the guideline published by Wechat user interface guide.

[b] Ishii K, Lyons MM, Carr SA. Revisiting media richness theory for today and future. *Hum Behav Emerg Technol*. 2019;1(2):124-131. doi:10.1002/hbe2.138

Figure 1. Emotional intensity and performance objectives

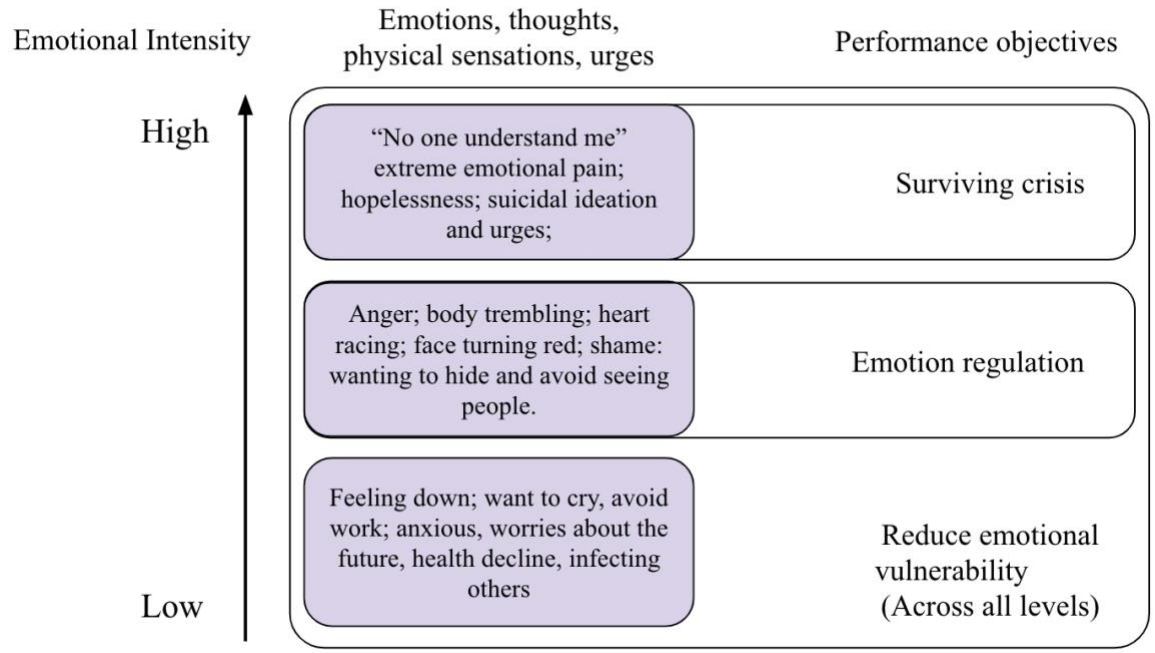
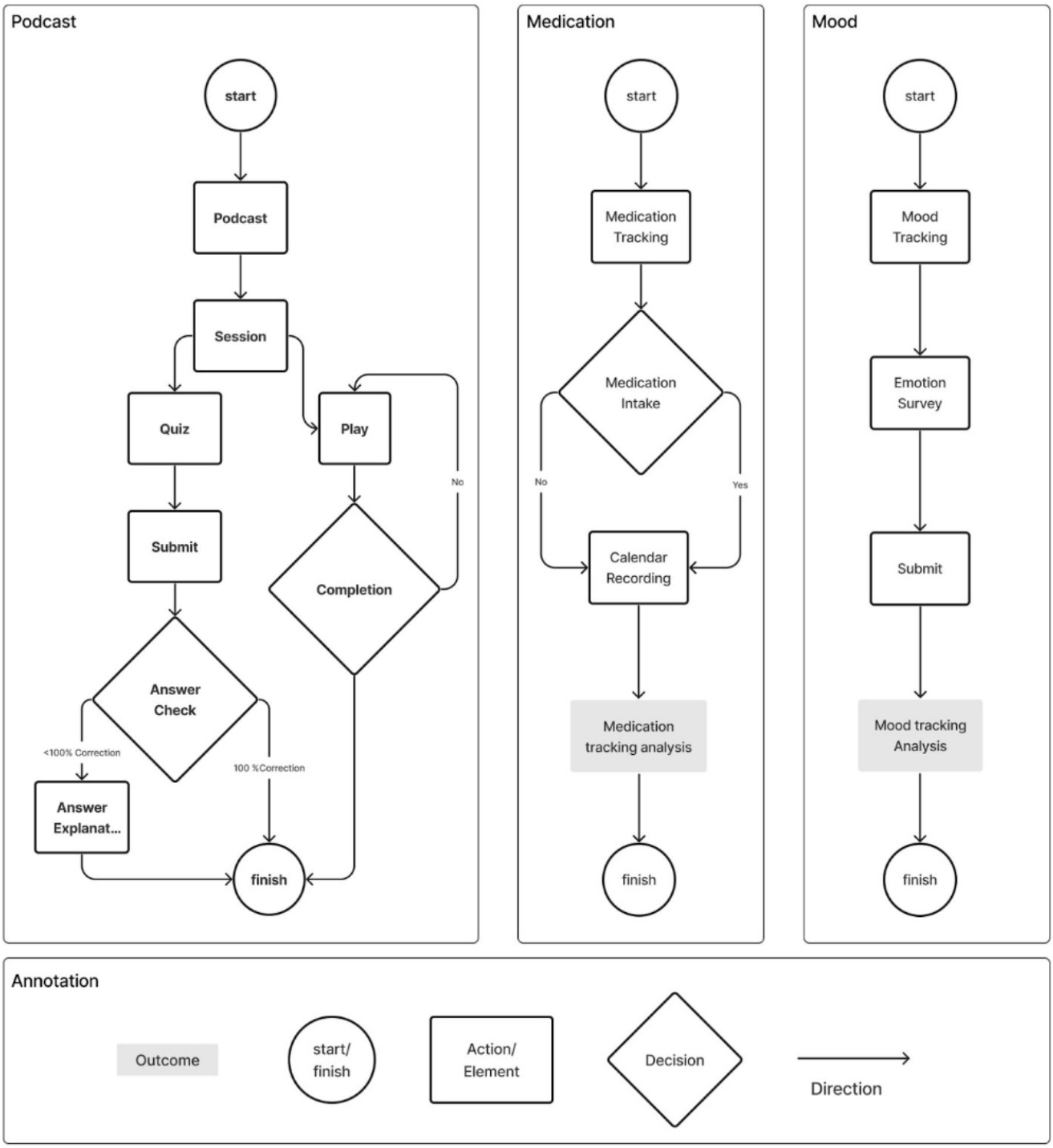


Figure 2. Intervention app workflow



Abbreviations

BIT model: behavioral intervention technology model

COM-B: capability-opportunity-motivation behavior model

DBT: Dialectical Behavior Therapy

EVF: ecological validity framework

HCD: human-centered design

IM: Intervention mapping

MSM: Men who have sex with men

mHealth: Behavioral health interventions delivered on mobile platforms (mHealth)

SCDC: Shanghai Municipal Centers for Disease Control and Prevention

SCMC: Shanghai CSW&MSM Center

Chapter 3. An mHealth intervention to enhance coping skills and mental health among MSM living with HIV in China: A feasibility pilot study

In preparation for submission: *JMIR mental health*

Abstract

Background: Men who have sex with men (MSM) bear a disproportionate burden of HIV and mental health problems in China, hindering HIV-related care engagement and medication adherence. We developed a multi-level, Dialectical Behavior Therapy (DBT)-informed mHealth intervention composed of individual skills training, online skills group, and on-demand skills coaching.

Aims: This feasibility pilot aims to 1) assess intervention acceptability, feasibility, and app usability; 2) evaluate the preliminary intervention effects.

Methods: This study used a 1:1 randomized design to assign participants to a 4-week mHealth intervention arm or control arm. Participants were recruited in collaboration with Shanghai China Sex Worder & Men Who Have Sex with Men Center (SCMC), a community-based organization that provides HIV-related services in Shanghai, China. The intervention included individual skills learning using an app, online skills group facilitated by trained SCMC staff, and on-demand skills coaching by trained SCMC staff. Both groups completed weekly surveys for 4 weeks. Data were analyzed using linear mixed-effects models to evaluate the intervention's impact on primary outcomes (depression, anxiety, quality of life, medication adherence) and intermediate outcomes (emotion regulation difficulties, HIV-related stigma, and coping self-efficacy). Intervention feasibility and acceptability were measured and summarized using descriptive statistics.

Results: Of the 64 people who completed the screening survey, 31 enrolled and completed the study without dropping out. The intervention (n = 16) and control arm (n = 14) did not differ in demographic characteristics, primary outcomes, or intermediate outcomes. Most participants

were 23-30 years old, college-educated, employed, and single. Overall, the intervention was perceived to be highly feasible and acceptable, with above-average app usability. Compared to control group, time was associated with a greater decrease in the following outcomes in the intervention group: depression (β = -0.73, 95%CI [-1.37, -0.10]), emotion regulation difficulties (β = -1.56, 95%CI [-2.72, -0.41]), specifically non-acceptance of emotions (β = -0.48, 95%CI [-0.88, -0.09]), and impact of emotions on goals (β = -0.37, 95%CI [-0.72, -0.03]). Participants in the intervention group also showed more improvement in HIV mastery ((β = 0.37, 95%CI [0.01, 0.74]), life satisfaction (β = 0.85, 95%CI [0.11, 1.59], coping efficacy around emotions (β = 0.97, 95%CI [0.06, 1.88]), and seeking social support from family and friend (β = 0.82, 95%CI [0.08, 1.57], compared with the control group.

Conclusion: The DBT-informed mHealth intervention is acceptable and feasible among MSM living with HIV in China. The promising intervention effects on reducing depression and emotional regulation difficulties warrant further investigation through larger randomized trials. This work has important implications for cross-cultural adaptations and extensions of traditional evidence-based treatment into digital mental health interventions to improve mental health outcomes among people living with HIV.

Introduction

In 2021, about 38.4 million people globally were living with HIV. HIV key populations, including gay men and other men who have sex with men (MSM), accounted for about 70% of new HIV infections. Compared to adult men, the risk of acquiring HIV is 28 times higher among MSM (UNAIDS, 2022). The MSM population shoulders a substantial burden of HIV in China (X. Zeng et al., 2016), and the prevalence of HIV among this population increased substantially between 2001 and 2018 according to a meta-regression analysis (Dong et al., 2019). The development and broader availability of antiretroviral therapy (ART) have significantly improved the quality of life and life expectancy for those affected by HIV (Gordon et al., 2020).

The bidirectional association between HIV-positive status and mental health problems is situated in a dynamic network of social and structural factors that contribute to both (Chuah et al., 2017; Remien et al., 2019). HIV, AIDS-related opportunistic infections, and the side effects of antiretroviral treatment can cause neurological damage and the development of mental health problems (Dubé et al. 2005; Spaan et al. 2018). Additionally, HIV- and sexual identity-related stigma are associated with lack of disclosure and hence social support (Logie & Gadalla, 2009; Smith et al., 2008; Takada et al., 2014). Without social support, some people may turn to substance abuse (eg., alcohol or drugs) to cope with the stress, negative emotions, and catastrophic thoughts (Lee et al., 2002; Nanni et al., 2015). Mental health problems such as depression subsequently negatively impact ART adherence and contribute to the development of AIDS, which ultimately leads to poor health outcomes and low quality of life (Buckingham et al., 2013; Spaan et al., 2018; Wykowski et al., 2019).

The MSM living with HIV in China experience higher prevalence of mental health conditions. The prevalence rates of moderate-to-severe depression among MSM in China ranged from 26.8% to 53.5%. The anxiety symptoms are elevated among MSM living with HIV (21%-42%), compared to HIV-negative MSM (12%-26%). These mental health challenges, combined with intense emotions related to HIV-related challenges, could lead to dysregulated behaviors such as suicide attempts (Chen et al., 2022) (Sun et al., 2020). However, the limited mental health resources in China are far from being able to address these urgent mental health needs. This mental health service gap is further exacerbated by mental health literacy and mental health related stigma and discrimination (Xu et al., 2022).

Digital health technologies (mHealth) can potentially increase the accessibility of mental health interventions (Torous et al., 2021). mHealth psychosocial interventions hold promise in improving mental health among the general population (Lecomte et al., 2020), people living with HIV (Cooper et al., 2017), and MSM living with HIV (Yu et al., 2022). mHealth interventions may be even more critical in a setting with limited mental health resources such as China as they are one pathway for increasing access to mental healthcare. However, a review of 63 mental health apps in China found that many apps simply served as coordination and communication platforms between mental health professionals and patients (Shang et al., 2019). These apps did not leverage the advantage of mHealth apps to directly increase the accessibility of mental health services. About 54% of the 63 apps provided psychoeducation around mental health, although the quality of the content requires closer examination as most (78%) of the apps were developed by commercial entities without a clear evidence base or consultation with mental health experts. Only two apps of the 63 apps reviewed used evidence-based treatment such as CBT. Almost all

the apps were designed to provide broad mental health services to general users without a specific disorder or patient population in mind.

Few mHealth intervention studies were conducted among PWH in China to improve mental health outcomes and medication adherence. Most existing mHealth interventions for people living with HIV in China target HIV self-testing (Zhu et al., 2019) and HIV transmission risk (Yan et al., 2020). A pilot RCT examined the feasibility and acceptability and a mHealth intervention among PWH in China (N = 62) (Guo et al., 2018). The 12-week-long intervention consists of two components: 1) weekly SMS text messages about medication adherence and regular exercise; 2) short articles sent three times a week related to medication self-management, stress management, and healthy lifestyle. Following the pilot RCT, the team carried out a fully powered RCT (N = 300) from September 2017 to October 2018, testing the efficacy of the WeChat-based intervention on depression among PWH in China. The reduction in CES-D score was significantly larger in the intervention group compared to the control group at 3-, 6- and 9-month follow-up (Guo et al., 2020). Positive coping and reduced HIV-related stigma were the mediating factors of the intervention effects on depression (M. Zhu et al., 2019). We could not locate any mHealth intervention research in China for MSM living with HIV that focuses on mental health and medication adherence.

Despite the promising results of mHealth interventions in addressing mental health needs while overcoming barriers to treatment access, such as stigma, common challenges with mHealth interventions include low engagement and high attrition rates (Christensen et al., 2011). App engagement is positively associated with effectiveness of app-based interventions (Y. Zeng et al., 2020). Existing evidence suggests that initial engagement with mHealth apps is difficult. The PTSD Coach app was downloaded 166,861 times, but only 14% of the individuals who

downloaded the app used the app the day after downloading (Owen et al., 2015). Adding a human guide and using human-centered design (HCD) are two approaches that could potentially reduce attrition and improve adherence. The majority of available mental health apps were designed to be self-guided, standalone apps (Areán et al., 2016). Peer involvement as an active component of the app-based intervention was associated with better overall intervention engagement through reciprocal accountability, shared experience, and bonding (Fortuna et al., 2019). Human-centered design processes emphasize users' needs, interests, and preferences (Jessen et al., 2018). Actively involving end-users in the design and development of smartphone interventions might improve intervention adherence (Linardon & Fuller-Tyszkiewicz, 2020).

To facilitate adaptive coping post-HIV diagnosis and improve mental health outcomes among MSM living with HIV in China, we developed a mHealth intervention using community-based participatory research (CBPR) approach and taking into account the app engagement challenge. Through needs assessment, we found the particularly interactive nature of environmental factors exacerbated the emotional distress among MSM living with HIV and identified gaps in individual coping skills and psychosocial services from the community (Wang, Simoni, et al., under review). MSM living with HIV could benefit from expanding their individual coping toolbox to more effectively cope with their emotional distress when support from others is lacking or unavailable (Harding et al., 2011).

Theory-based behavioral interventions are more effective in leading to behavioral change compared to those without a theoretical basis (Lycett et al., 2018). The theoretical basis of the current intervention content is derived from the Dialectical Behavior Therapy (DBT) model of emotions and emotion regulation, which fits our conceptualization of intervention users' mental health needs (detailed rationale see Chapter 2; (Wang, Yuwen, et al., under review). Briefly,

DBT model of emotion captures how the cognitive, physiological, behavioral processes, and the context of emotional experience interact and generate emotional experiences. According to the model, an individual first encounters and interprets a prompting event which can be followed directly by biological changes (e.g., heart rate, body temperature) or by an interpretation of the event which leads to biological changes. These biological changes are accompanied by behavioral and verbal expressions. These parts together comprise an emotional response. Notably, this model takes into account the context of the emotional experience, named "the pre-existing vulnerability factors" (Linehan 2014). DBT was originally developed for suicidal and para-suicidal behaviors and later expanded to treat individuals with borderline personality disorder (BPD) and other disorders characterized by emotion dysregulation (Neacsiu et al. 2014). Empirical evidence supports the efficacy of DBT in reducing emotion dysregulation, self-harm, suicidal behaviors, and hospital visits (Neacsiu et al. 2014; DeCou et al. 2019). Standard outpatient DBT model includes individual therapy, skills training class, phone coaching, and consultation team. DBT skills training as a primary intervention demonstrates efficacy in improving a range of outcomes (Valentine et al. 2020). We adapted the model of skills training as a primary intervention to overcome the lack of trained DBT therapists in the community while endeavoring to maintain the complementary effects of the components (Wang, Yuwen, et al., under review). The developed intervention components include: 1) individual DBT-based coping skills training delivered on a mobile app, 2) weekly online skill training groups facilitated by trained lay providers, and 3) phone coaching on skills generalization delivered by trained lay providers. This multi-level delivery modality could optimize participants' engagement with the mHealth intervention, and the staff training component will lay the foundation for project sustainability.

This feasibility pilot study aims to use a mixed-method approach to: 1) assess intervention acceptability, feasibility, and app usability; 2) evaluate the preliminary efficacy of the intervention, including mental health outcomes, quality of life, medication adherence, and intermediate outcomes (e.g., difficulties in emotion regulation).

Methods

Study design

This study is a pilot feasibility 1:1 randomized control trial (4 weeks) on an DBT-informed mHealth intervention for MSM living with HIV, with qualitative and quantitative process evaluation. Study participants included intervention target users (MSM living with HIV) and SCMC staff who assisted in the delivery of the intervention. MSM living with HIV either received treatment as usual (TAU) from SCMC according to the post-diagnosis service guideline or the DBT-informed mHealth intervention. The intervention included individual coping skills learning through an app, SCMC staff-facilitated online skills group, and on-demand phone coaching in skills practice.

Patient and public involvement

This intervention and study protocol were designed in close collaboration with staff from SCMC and target intervention users using community participatory approach and user-centered principles and strategies. The detailed development process was reported elsewhere (Wang, Simoni, et al., under review; Wang, Yuwen, et al., under review). Briefly, we conducted a needs assessment with stakeholders (SCMC staff, SCDC staff, and MSM living with HIV), followed by online co-design sessions with MSM living with HIV, and iteratively design and development of intervention content and delivery. This protocol was developed in close consultation with our community partners. At the end of the study, a report will be prepared to share the results to study participants and SCMC staff. We will also share updates regarding further trials and new versions of the app through email and WeChat messages to the study participants and SCMC staff.

Eligibility criteria

Inclusion criteria for intervention target users included self-identified as MSM (18+ years), being fluent in Chinese, reporting at least mild depressive symptoms (scored at least five on PHQ-9), being HIV-positive, being diagnosed within the past six months (later expanded to within past three years to due to recruitment difficulty), and using ART. Intervention target users were excluded from the study if (1) they were unable or unwilling to provide informed consent; (2) reported active suicide ideation when probed based on the last question of PHQ-9; (3) self-reported diagnoses of severe mental illnesses (e.g., psychosis); (4) have been prescribed psychotropic medication; (5) currently receiving psychotherapy. A self-reported screening survey was used to determine study eligibility. The study team, including the research team from UW and SCMC staff, met online as needed to discuss cases that are unclear regarding their eligibility.

Inclusion criteria for SCMC staff as online group facilitators are as follows: (1) has at least a year of experience working with MSM and HIV post diagnosis consultations at SCMC; (2) has regular access to the internet via phone or computer; (3) agree to receive staff training to learn the skills required to serve as group facilitators in the study; (4) agree to facilitate online group for 50 min per week; (5) agree to attend 1-hour weekly online group supervision; (6) agree to complete the intervention content on WeChat mini-program; (7) socially skilled as perceived by SCMC staff. Staff members were excluded if they were under 18 years old and currently in treatment for mental health conditions.

Study procedures

Recruitment and informed consent

Participants were recruited in collaboration with Shanghai CSW&MSM Center (SCMC), a community-based organization that provides HIV-related services such as HIV testing, health education, and brief counseling. Figure 1 presents the participant enrollment procedure. A digital survey containing the study information and questions to screen for eligibility was shared with a WeChat group managed by SCMC. WeChat is a multifunctional messaging, social media, and mobile payment application that has 1.3 billion monthly active users as of March 2023 (WeChat: active users worldwide 2023). It offers services including text messaging, voice and video calls, games, and an integrated wallet feature, making it a central part of digital life in China and increasingly popular worldwide. Following the routine service guideline at SCMC, all individuals newly diagnosed with HIV were added to the WeChat group. The Wechat Group serves as a channel for SCMC to share HIV-related information and a platform for members of the community to share resources and support each other. To overcome recruitment difficulties and increase the response rate, SCMC staff also reached out individually to clients who utilized post-diagnosis services at SCMC in the past. Interested individuals completed the screening survey to determine their eligibility for the study. Those who met the initial eligibility criteria were then contacted via preferred way of communication (e.g., WeChat, text) by a member of the research team to attend a study onboarding meeting. At the meeting, the researcher team introduced detailed study procedures in their assigned groups (intervention content details see below), obtained informed consent, and conducted a full baseline assessment (measures details below). The study obtained approval for all study procedures from the University of Washington Institutional Review Board.

Randomization

We used block and stratified randomization to ensure balance in sample size across intervention and control groups over time and minimize the influence of covariates. The stratification factors were PHQ-9 score (<15 vs. ≥15) and time since HIV diagnosis (<6 vs. ≥ 6 months), because both are confounding variables that could influence the clinical outcomes. The target sample size of this study was 30. We chose 2 to be the block randomization size to allow easier control of balance (Suresh, 2011). Using an online block randomization list generator, we randomly assigned blocks of participants to intervention or control conditions. Three SCMC staff were randomly assigned to facilitate the online skills groups that each contained 3-4 participants.

Study arms

Control group

Participants received treatment as usual, i.e. the routine service from SCMC and Shanghai Municipal Centers for Disease Control and Prevention. After an individual is tested positive for HIV at the CBO, a staff member immediately follows up with the individual to introduce the procedure of scheduling physical exams, sign up for free ART at Shanghai CDC, and provide general knowledge about HIV management. SCMC staff also provide emotional support when individuals are in distress. In addition, the CBO organizes a monthly retreat (usually a weekend trip) for MSM who tested positive for HIV to get together, share experiences, and offer each other support. Additionally, following the HIV/AIDS treatment standard in China, individuals

living with HIV visit their primary health care providers in the designated hospital (specialized in HIV-related services) for medication refilling and physical exams. Case managers at Shanghai CDC contact all HIV-positive individuals in the district every three months to check in about medication adherence and other health conditions.

Participants in the control group received links to their weekly assessments via their preferred way of communication (via email or WeChat). A study staff member contacted the participants after the links were sent to ensure they completed the assessments on time.

Intervention group

All participants in the intervention group received the 4-week DBT-informed intervention. The intervention drew from DBT skills (specifically emotion regulation and distress tolerance skills) and was adapted to meet the needs of the targeted intervention user in the cultural context (See Chapter 2). The intervention program includes three components: (1) individual skill learning using the mobile app supported by (2) a staff-facilitated skills group and (3) on-demand phone coaching.

Individual skills learning via app

The content of individual skill learning includes the following modules delivered on the app as podcasts: 1) Psychoeducation of emotions: the process of emotional response, types of emotions, emotional intensity, and functions of emotions; 2) How to get through a crisis situation: TIPP (temperature, intense exercise, paced breathing, and paired muscle relaxation) and self-soothe skills; 3) How to relieve emotional suffering: reality acceptance skills; 4) How to regulate emotions that are not effective given a certain goal in the context and how to reduce emotional

vulnerability: opposite action and ABC PLEASE skills; 5) Summary of all skills and highlight of takeaways. A brief overview of module content and outline is shown in Table 1.

Group-based skills training

In addition to learning skills through the app on their own, intervention group participants attended small, online weekly skills groups (3 group members each group) facilitated by trained SCMC staff for four weeks. The skills training sessions were designed to be paired with the module content on the app. Individuals were instructed to complete one module of content every week to prepare for group discussion. A wechat group was created once individuals were assigned to an online skills group. Each WeChat group included the three group members and the SCMC staff designated to be the group facilitator. Before each week's group, the staff would send reminders that contained the following information: 1) meeting of the online skills group; 2) Video Conference link; 3) the module that needed to be completed on the app prior to the group. Participants who missed the group were contacted by the lead author to review the session recording together before the next group to be able to continue with the intervention.

The skills training groups were designed to be 1hr long, but in practice lasted about 0.5-2 hr, and consisted of the following components: 1) mindfulness practice (5-7 min); 2) summary of the skills covered by the app in the week prior to this session (5-10 min); 3) homework and quiz review (45 min); 5) preview of next week's content (5-10 min); 6) assign worksheet for next week and goal setting for next week (5 min). All online groups were recorded for further qualitative analysis.

In addition to the components listed above, the first online skills group also included: 1) to orient the group members to the purpose of skills training, introducing the skill deficit model of

emotional and behavioral dysregulation and outlining the content covered in this intervention; 2) to introduce the group format and guidelines, including the roles of the skill trainer (i.e. SCMC staff) and the group members; 3) for group members and SCMC staff to get to know each other; 4) for individual group members to share their personal goals through this intervention, including behaviors to decrease and skills to increase.

To ensure appropriate behaviors during online skills groups, a set of guidelines were introduced both in participant onboarding meetings and in the first skills group. The detailed guidelines were reported elsewhere (Chapter 2; Wang, Yuwen, et al., under review). Briefly, participants were expected to: 1) protect each other's confidentiality, validate, support, and provide noncritical feedback to group members; 2) communicate of time conflicts occurs and unable to attend group; 3) discuss dysfunctional behaviors (e.g. self-injury and substance use) in limited detail while put the emphasis on adaptive skill use; 4) not establish relationships outside of groups.

Phone coaching

Additionally, the SCMC staff were available for between-session skills coaching via phone call or text. Phone coaching aims to 1) facilitate skills generalization, 2) coach individuals to get through crisis situations when dysregulated behavior may occur and cause harm, 3) shape individuals' behavior of asking for help effectively.

Staff training and supervision

SCMC staff training with 6 SCMC staff was conducted online using a video conferencing platform. The training was completed in five 2-hour long sessions across 2 weeks and covered the following content: 1) General therapy techniques: validation skills, problem-solving; 2) DBT

skills used in the intervention study: functions of emotions and emotional intensity, crisis survival skills, reality acceptance skills, emotional regulation skills; 3) Suicide risk assessment, referral, brief crisis intervention (e.g., hope generating strategies; restriction of means); 4) Orientation to the intervention study, skills group, and phone coaching protocol. All staff training sessions were recorded for further qualitative analysis.

The structure of the training session was designed to be parallel to the online skill sessions SCMC staff would facilitate to increase their familiarity with the flow of the group. Specifically, within each training session, we started with a mindfulness practice, followed by reviewing last week's practice homework, teaching new content, practicing in pairs, and Q&A. Training schedule and materials see appendix 1. Two weeks after training completion, we conducted online interviews to understand the acceptability and feasibility of the training program. Due to schedule conflicts, a focus group of 3 staff was first conducted. Individual interviews were conducted with the other three staff members (Appendix 1).

SCMC staff who participated in the intervention study as skills group facilitators also attended weekly supervision meetings with LW (therapist in training) and the LC (counselor in training). The first author also met with a licensed clinical psychologist biweekly to consult on supervision strategies and questions related to facilitating the skills group. LW and LC reviewed the recordings of the skills groups and provided feedback on the following aspects: 1) delivery of the group components following the designed group structure (e.g., starts with mindfulness practice, ends with a preview of next week's content and homework); 2) checking-in and problem-solving around the podcast and quiz competition; 3) clarity of brief didactic review of the podcast; 4) general therapeutic skills (e.g., validation, empathy, reflection and summary, labeling emotions, labeling skills used); 5) engaging the group members and eliciting examples of skill use from

group members to facilitate peer learning; 6) the interactions between the group facilitator and the group member and among group members (group dynamic: speed, movement, and flow).

App main features

The app includes three main features: 1) podcasts to deliver DBT-based skills, followed by questions; 2) tracking and visualization of medication adherence and depression; 3) optional guided meditation content (Table 2. Main app features).

Podcasts

The five podcasts each delivered one module of content in the form of a mock therapy session. Each podcast lasts 10-15 min. The podcasts were accompanied by 1) outlines with key takeaway points to help users follow the audio content and 2) four to five quiz multiple-choice quiz questions to assist the users in consolidating their learning and preparing for the online skills group. In the podcasts, a graduate student therapist in training (LW) and a counselor in training (LX) roleplayed the therapist and a client working through how to use various DBT-based skills to cope with difficult emotions brought by life events. Extensive efforts were made to tailor the stories used in the roleplay to problems and emotional distress commonly seen among MSM living with HIV, so users could easily relate the podcast material to their own lives. Meanwhile, we intentionally did not use any HIV-related terms in the podcasts or in overall app design (e.g., HIV diagnosis, ART medication) to reduce the chance of accidental disclosure.

Tracking and visualization of medication adherence and depression

Users who took ART daily were recommended to use the medication tracking feature on the app to record whether they had taken medication on a given day. Once users click the medication

tracking icon on the homepage to arrive at a calendar page with a pop-up window asking, “Have you taken meditation for today?” and the user either clicks yes or no to indicate their answer. The user flow of the page was finalized after three rounds of usability testing, to optimize user experience and minimize the barriers/burden users face to track medication. Additionally, we use confetti combined with “Congrats!” once the user clicks “yes” to indicate that they had taken medication, to serve as an immediate reinforcer of users’ medication adherence behavior. Medication tracking record is visualized using a bar graph, with each bar summarizing the number of days out of a week a given user took medication.

Intervention group users were also encouraged to use the PHQ-9 tracking feature to record their weekly depression symptoms. The user clicks the mood tracking icon on the homepage to enter the PHQ-9 questions. After the user finishes all the questions, they can view a visualization of the PHQ-9 scores they have received up till the most recent record. The PHQ-9 score over time is visualized using a line graph, to reflect the trend of change in depression symptoms for the user. We also provide a brief explanation of the meaning of the score in lay language (e.g., “Seems like you are feeling down over the past week.”) followed by a suggested action item or question to prompt action (e.g., “Would you like to try some strategies to feel better?”).

Guided meditation

We created a list of guided meditations for users to use, in addition to the podcasts that deliver DBT skills. The three meditations included: paired muscle relaxation, observing emotions, and observing thoughts. The paired muscle relaxation meditation was first created as an experiential practice of the distress tolerance skills. Observing is one of a set of fundamental mindfulness skills that all DBT skills are based on (Linehan 2014). Therefore, we included two other

meditations focusing on observing emotions and thoughts in addition to observing bodily sensations emphasized by the paired muscle relaxation. This content was optional, and users were encouraged to explore and use it but were not required to complete it as part of the intervention.

Measures

Participant demographics

Demographic information of study participants (living with HIV and SCMC staff) were collected, including age, education level, monthly income, employment, marital status, Hukou (official residential status), relationship status, duration of HIV infection (when applicable), and ethnicity.

Feasibility, acceptability, and app usability

Table 3 presents the feasibility and acceptability outcomes and evaluation methods. Feasibility outcomes captured methodological, procedural, and clinical uncertainties to inform the design of a definitive RCT. The methodological outcomes included eligibility criteria, recruitment rates, response rates, attrition rates, and appropriateness of measures. The procedural outcomes included the recruitment process, consent process, data collection process, resources needed for study, and staff training logistics. The clinical uncertainties included the intervention user's adherence to the intervention (user activity data on the app, skills group attendance), and SCMC staff's adherence to the skills group protocol.

For overall intervention feasibility and acceptability, we conducted one-on-one study exit interviews with intervention users with questions adapted from (Cruz et al., 2021)(Wall et al.,

2020)(Belus et al., 2022)(Haroz et al., 2019; Larsen et al., 1979). Intervention users also filled out quantitative surveys of acceptability and feasibility, as listed below. Same questions and measures were used to assess the acceptability and feasibility from the perspective of SCMC staff, with a slight change of wording. Additional questions for SCMC staff assessed staff training acceptability and feasibility (Appendix 2).

Acceptability measures

Acceptability of intervention was measured by questions adapted from a five-item formative measures of acceptability (Haroz et al. 2019).The formative measure of acceptability is more appropriate because the acceptability of an intervention or training is not an innate trait or quality (reflective construct), rather a formative construct that is formulated through the items used to measure it. Participants indicated their level of agreement to items on a 5-point response scale (1=strongly disagree, 5=strongly agree). The Client Satisfaction Questionnaire (CSQ) was used to capture additional factors (e.g., To what extent has the program met your needs?) that might have influenced the acceptability outcome (Larsen et al., 1979).

Feasibility measure

Feasibility of intervention was measured using the 9 out of 12 items of the formative measure of feasibility from (Haroz et al. 2019). Items that were irrelevant to the current study context were removed. For example, this study was online so the item was excluded: “I have enough time to travel to and from the group.” One additional item was added to measure staff perceived intervention feasibility in the domain of facilitator skills (“I believe I am sufficiently skilled at facilitating the online groups”).

App usability

The usability of the mini-program was assessed at the end of the study using the System Usability Scale (SUS). The SUS is a 5-point Likert scale (1 = "strongly agree" to 5 = "strongly disagree") with 10 items that assess system usability and learnability (Bangor et al., 2009). SUS has been validated in many studies, and its reliability has been demonstrated. The total score of all items were converted to a 0-100 scale, with a higher score suggesting better usability. A score of 70 or greater indicates acceptable usability (Bangor et al., 2009).

Clinical outcomes

Clinical outcomes included: 1) mental health outcomes (depression and anxiety); 2) medication adherence; 3) quality of life. All clinical outcomes were measured at baseline and end of intervention. Additionally, mental health outcomes were also measured weekly during the 4-week study period.

Mental health outcomes

Depressive symptoms over the prior two weeks were measured with the Patient Health Questionnaire-9 (PHQ-9). Participants indicated how often they experienced depressive symptoms over the past two weeks by choosing among four response options, from 0=not at all to 3=nearly every day. A total score was calculated by summing individual responses, with a higher score indicating more severe depression. A total score of 5, 10, 15, and 20 indicated mild, moderate, moderately severe, and severe depression (Kroenke et al. 2001).

Anxiety symptoms were measured using the General Anxiety Disorder-7 (GAD-7). Participants indicated how frequently they experienced these symptoms by choosing from four response options, from 0=not at all to 3=nearly every day. A total score was calculated by summing the

responses to all items, with a higher score indicating more severe anxiety. The GAD-7 score was analyzed as a continuous outcome. A total of 5, 10, and 15 indicated mild, moderate, and severe anxiety (Kroenke et al. 2007).

Quality of life

Quality of life was measured using the HIV/AIDS Targeted Quality of Life Instrument. This 42-item scale captured nine dimensions of quality of life for people living with HIV, including overall function, life satisfaction, health worries, financial worries, medication worries, HIV mastery, disclosure worries, provider trust, and sexual functions (Sousa et al., 1999). Reliability coefficients across the dimensions range from 0.83 to 0.88 (Holzemer et al., 2000). The sum scores were calculated for each dimension and the full scale (Webel et al., 2013).

Medication adherence

Medication adherence was measured with survey questions that ask participants to recall the past 30 days and answer the following questions: 1) In the last 30 days, on how many days did you miss at least one dose of any of your HIV medicines; 2) In the last 30 days, how good a job did you do at taking your HIV medicines in the way you were supposed to? (response ranges from very 1=poor to 6=excellent); 3) In the last 30 days, how often did you take your HIV medicines in the way you were supposed to? (response ranges from 1=never to 6=always). We performed linear transformation on the item responses to compose the adherence score (with range 0-100), with higher scores indicating better adherence (Wilson et al., 2016).

Potential mechanisms of change (intermediate outcomes)

Variables hypothesized as the mechanism of change included: 1) difficulties in emotion regulation; 2) coping self-efficacy; 3) and internalized HIV stigma. All intermediate outcomes were measured at baseline and at weekly follow-ups during the 4-week study period.

Difficulties in emotion regulation

Difficulties in emotion regulation were measured using the Difficulties in Emotion Regulation-Short Form (DERS-SF) (Kaufman et al., 2016). The 18-item scale covered six dimensions of emotion regulation, including strategies, non-acceptance of emotions, emotion-related impulse, impact of emotions on goals, awareness of emotions, and clarity regarding one's emotions. Participants indicated how often they perceived the items applied to themselves by choosing from responses that ranged from 1 to 5, where 1 = almost never, 2 = sometimes, 3 = about half the time, 4 = most of the time, and 5 = almost always. Sum scores of the full scale and subscales were calculated, with higher score indicating more difficulties in emotion regulation.

Coping self-efficacy

Participants perceived coping self-efficacy for challenges around living with HIV was measured using the 13-item Coping Self-Efficacy (CSE) scale (Chesney et al., 2006). Participants were first asked "When things aren't going well for you, or when you're having problems, how confident or certain are you that you can do the following" and responded on a sliding scale from 0 ("cannot do it at all") to 10 ("certainly can do") to indicate their confidence in performing the adaptive coping behaviors that fell into the following three categories use of problem-focused coping (6 items), stopping unpleasant emotions and thoughts (4 items), and getting support from

friends and family (3 items). Sum scores were calculated for subscales and the full scale, with higher scores indicating higher coping self-efficacy.

Internalized HIV stigma

The internalized HIV stigma was measured using the 12-item short version of the HIV stigma scale (Reinius et al., 2017). The scale measured four aspects of HIV stigma, including personalized stigma, disclosure concerns, concerns about public attitudes, and negative self-image. Participants responded on a 1 (strongly disagree) to 4 (strongly agree) response scale, indicating the extent to which they believed each statement was true for them. The sum scores of all items was calculated for subscales and the full scale, with higher scores reflecting a higher level of stigma.

Data collection and management

Quantitative measurement data were collected via an online survey platform widely used for research purposes in China. To minimize missing data in the weekly followup surveys, reminders were sent via WeChat with participants' approval to prompt them to fill out the survey for a given week. Qualitative data (interview data, staff training sessions, and online group sessions) were collected through video conferencing. All interviews were recorded and transcribed for analysis.

Quantitative data analyses

Feasibility and acceptability outcomes

The CONSORT diagram (Figure 1. CONSORT diagram) for pilot and feasibility studies was used to present participant flow. Specifically, the diagram presented the number of participants

who were interested and filled out the survey, assessed for eligibility, consented, and included in the study. Feasibility, acceptability, and app usability data collected using quantitative survey items were summarized using appropriate descriptive statistics (means and SDs).

Clinical outcomes

The intent-to-treat (last observation carry forward) were applied to all analyses of clinical outcomes and intermediate outcomes. Data were summarized (means and SDs for continuous measures and percentages for categorical measures) and compared between intervention and control groups at baseline and across all follow-up points.

Intervention effects on clinical outcomes (depression, anxiety, quality of life) were estimated using a linear mixed-effect model (LMM) with repeated measures. The current models were unadjusted due to small sample size. Once data collection is completed, we will adjust for baseline score and other baseline demographic characteristics (e.g., age, education level, income level, marital status, and employment). R package nlme was used to perform LMM. Similar analyses were conducted for intermediate outcomes, including difficulties in emotion regulation, coping self-efficacy, and HIV-related stigma. Sum scores of the full scales were used in all analysis. All analyses were performed using R and a two-sided $p < .05$ will be considered statistically significant.

Qualitative analyses

The available interview data were transcribed and summarized to extract key takeaways in this interim analysis. Once study is completed, all qualitative interviews will be analyzed using content analysis. The interview audio recordings will be transcribed first and then imported into

Atlas.ti for analysis. The analysis will follow the steps presented in Table 4 (Elo & Kyngäs, 2008; Fereday & Muir-Cochrane, 2006).

Results

Figure 1 presented the number of participants throughout the stages of the study. Among 31 participants who filled out the baseline survey, 17 were randomized to the intervention group, 14 in the control group. Intervention group participants were assigned to five groups, each facilitated by a SCMC staff. One participant randomized to Group C withdrew from the study after the first baseline survey, due to schedule conflicts. The rest of intervention participants completed the intervention and received exit interviews. Of note, two participants in Group B each missed an online skills session. Following the study protocol, they were contacted by the lead author (LW) to review the session recordings online before the following week's group. All participants in the control were retained in the study after filling out the baseline survey and completed the weekly follow-up survey for four weeks.

Participants characteristics

Table 5 presents the study participant demographic characteristics. There was no significant difference between participants in the control and intervention groups in demographic characteristics. The majority of participants were young adults aged between 23~35 (21 out of 30, 81%), of Han ethnicity (28 out of 11, 93%), obtained a college degree or above (21 out of 30, 70%), employed (23 out of 30, 77%), and earned a monthly income above 5,000 RMB/723 USD (23 out of 30, 77%). Most participants identified as gay (26 out of 30, 87%) and single (20 out of 30, 67%). One participant was married with a female partner. The duration since receiving an HIV diagnosis ranged from three months to about 14 years. Of note, only 8 out of 30 participants

(27%) had local Shanghai Hukou (residential status), which gave access to local healthcare through insurance and auto-enrolment into the program at the local CDC to obtain free ART and HIV-related services. Three participants (two in the intervention group and one in control group) were excluded from the analysis on medication adherence due to expected financial or logistical challenges in accessing medication. All SCMC staff in this study were male, the majority of which obtained a college degree or above (5 out of 6, 83.3%) and earned a monthly income above 5,000 RMB (~723 USD). (**Table 6)**

Intervention feasibility, acceptability, and usability (quantitative results)

Feasibility

Overall, the formative feasibility items indicated high feasibility of the intervention perceived by the participants in the intervention group (n = 16), with most mean scores of the items falling between 4 ("agree") and 5 ("strongly agree"). The item that scored lowest was "I have enough time for all the activities that go into learning the skills and participating in the online groups" (M = 4.2. SD = 0.9). The item that scored highest was "I have the right equipment to participate in this study (e.g., laptop, smartphone)" (M = 4.9, SD = 0.3). (Table 7)

Acceptability

The formative acceptability items indicated high acceptability perceived by the intervention group participants (n = 16), with mean scores of all items falling between 4 ("agree") and 5 ("strongly agree"). The item that scored lowest was "I continue to enjoy learning the skills" (M = 3.9, SD = 1.1). The item that received the highest mean score was "I was satisfied with the support I received from SCMC staff when I was learning the skills" (M = 4.8, SD = 0.4). (Table 7)

The CSQ items reflected a similarly high level of acceptability, with all items scoring above 4 (5 as the maximum score). Specifically, participants rated the program as high quality (M = 4.6, SD = 0.5) and that the program helped them deal more effectively with their emotional difficulties (M = 4.5, SD = 0.5). Participants also expressed a high willingness to use this program in the future (M = 4.5, SD = 0.5) and recommend this program to others (M = 4.4, SD = 0.5). (**Table 7**)

Usability

Participants reported an overall positive experience using the app, indicated by the mean score of SUS (M = 73.1, SD = 15.9). This mean score was above 68, a threshold that marks the average system usability (Brooke, 1996). The following usability items received the highest rating: the app was easy to use (M = 3.3, SD = 0.8), required little learning to navigate the system for themselves (M = 3.2, SD = 0.9), and that most people would be able to use it without much difficulty (M = 3.5, SD = 0.6). (Table 7)

Intervention feasibility, acceptability, and app usability (qualitative results)

Exit interviews were conducted with 16 participants who have completed the intervention. The qualitative findings revealed additional nuances of participants' experience during the intervention.

Feasibility

Overall, the participants found the time required by the intervention program manageable and not too burdensome. The format of individual skills learning combined with online skills groups was perceived to be complementary and essential for comprehensive learning. Participants expressed appreciation for the structure and accountability provided by the combination. The app was seen

as a tool for preview and review of materials, as well as a unifying platform for continued connection outside of the group. Group sessions provided motivation and reminders for app engagement.

> ID13: *…without the group, I might forget to use the app and listen to the podcast. The group serves as a reminder. I can also learn from my peers in the group. Self-learning using the app can help increase the efficiency of the group, but my overall experience wouldn't be impacted much if the app was removed.*

Regarding the size of the online group, participants expressed mixed opinions. Some participants appreciated the current size of the group (2~4 per group), which offered enough time for each member to share while not prolonging the length of the group session. Others expressed desire for more members in the group, which might bring in diverse perspectives and engagement. They also found the setup of the online skills group helped protect their privacy and made them feel safe and more relaxed to engage in conversations during the group.

Although participants did not find podcasts in the intervention exceptionally long, some expressed preference for shorter content (5-10 min) which is more feasible for their daily schedule. Some participants suggested integrating app content directly into group sessions to further reduce user burden.

Acceptability

Participants reported benefits from this intervention from multiple dimensions. Participants overall reported improved awareness of emotions and increased self-efficacy in managing emotions. Several participants found the framework of emotional intensity ladders to be helpful for them to practice observation of emotions and practice skills accordingly. They found the

skills taught through the intervention practical for emotion regulation and will continue to apply the skills in their lives. Some participants found the skill ("radical acceptance") to be consistent with the core beliefs ("Ziran and Wu wei", a state of as-it-isness and non action) in Chinese philosophy, Taoism.

> ID25: *I'm not someone who gets heated up easily. I'm more prone to feeling down and low energy. I know now that I can do small things to generate positive emotions, maybe take a walk somewhere, or talk to my friends.*
>
> *ID32: I now know that I can use five senses and physical sensations to quickly reduce intensity of extreme emotions. I also learned that mindfulness practice help me feel peaceful. Overall, my acceptance of emotions has increased.*

To further improve the content of the intervention, participants suggested the usage of more specific examples in the podcasts and integration of HIV-specific topics such as tips on medication and navigating stigma. One participant found the content to be helpful for difficulties with emotions and would like to see a wider range of topics and options (ID8). For example, he suggested including content on interpersonal skills, which would help him to communicate his needs and obtain help more effectively.

Intervention participants found connecting with others emotionally as a major gain of joining the skills group. They also stated that they gained support and warmth from group interactions and experienced an improved mood after group attendance. Participants gained new perspectives on coping with living with HIV through skills learning and shared experiences living with HIV among group members.

ID13: *Overall my mood has become better since I joined the online group and started this intervention. This has been very helpful to me.*

Participants perceived the structure of the session to be both beneficial and limiting at times, expressing interest in a balance between structured discussion around pre-selected topics and topics organically occurring among members in session. Participants also reported mixed experiences with mindfulness practice, with some reporting feeling grounded and focused for the group session, while others found the relaxing effect to be so strong that they could not focus on the group afterwards, especially because the group sessions were usually at night time.

ID39: *The group follows topics (around emotional wellbeing) that build upon each other over the course of the program. It also allows the group members to share experiences and learn from each other.*

ID35: *Letting members bring their own topics of interest might increase engagement and increase the "freshness" of the discussion topics.*

Participants appreciated the qualities of the SCMC staff serving as group facilitators, such as patience, genuine care, empathy, and the ability to establish group guidelines and rules. They also expressed desire for SCMC staff to more effectively manage group dynamics and different opinions from members, as well the ability to highlight the key points of a podcast and better time management.

ID9: *The SCMC staff was very caring towards us. He always asked us if we listened to the podcast. If we did not have time to listen, he would spend a few more minutes explaining in detail or re-listen to the podcast with us.*

Participants found the role-play format of the podcasts to be interactive and engaging. They also expressed desire for diverse forms of presentation of information to tailor to users preferences. Some participants suggested that the podcast could be adapted to a talk show to convey the key concepts and skills in a more concise and straightforward way. While participants found the content easy to follow, some would like to have subtitles or transcriptions added to the podcast to aid their understanding of the content.

Participants expressed a high willingness to participate in future interventions, citing emotional and social benefits of group-based learning as their major motivation. Time constraint was the main concern from the participants regarding attendance of group-based interventions integrated into community services. Several participants already recommended our app to their friends, who they believed may benefit from the content.

Usability

Overall, participants found the app to be simple and easy to use. One participant (ID8) found the app to be unstable and sometimes created challenges when he tried to access the content. One participant (ID9) found the medication tracking feature very useful to help him keep track of whether he has taken medication for a given day. Although he wasn't able to consistently use it everyday throughout the study period, he expressed desire to keep using it even after study completion. Additional features participants suggested as could be potentially helpful included adding a note taking feature for side effects tracking and reminders sent to their phone for medication adherence.

> ID9: *Medication tracking is a great feature! Please make sure to keep this feature in the app. I will definitely keep using this.*

Staff training feasibility and acceptability

Training Feasibility

SCMC staff found the training session length appropriate (2 hours) and did not cause too much burden. Staff reported difficulty in absorbing all training materials, given the relatively large amount of information covered during sessions and short interval between sessions. Without much time to digest and practice the skills, they expressed worries about whether they can effectively apply what they have learned to leading the skills groups. To increase their readiness, the staff recommended the sessions be spread out across multiple weeks, with one to two training sessions every week. This would allow for more time to consolidate learned skills in-between training sessions.

While acknowledging that training materials were delivered through video-conferencing without significant challenge, staff expressed preference for in-person training. Staff believed that in-person training would be more engaging and thus produce better training outcomes. Regarding the structure of each training session, staff suggested the mindfulness practice at the beginning of the training sessions be shortened to leave more time for other training content. The time management within sessions could also be improved, requiring the trainers more frequently redirecting the diverging discussion back to the training topic. For future training, the staff suggested using short video recordings to deliver each skill demonstration so that staff can review the recordings before and after the training. To further improve the completeness of training, staff suggested adding an assessment component at the end of each training session to help staff members identify areas of strengths and weakness and seek supervision/consultation as needed.

Staff reported strong institutional support from SCMC to receive this training. The director of SCMC expressed strong support for training that could equip staff with knowledge and skills that could be applied to improving their work with clients. Outside of training, some SCMC staff reported reading self-help books, websites, and articles on social media (e.g., WeChat public account) to learn psychological and mental health-related knowledge. Some found it boring to just learn on their own through reading. They also acknowledged that they usually wouldn't intentionally seek out training due to their demanding schedules.

Training Acceptability

Identity shift

The staff realized the importance of establishing professional boundaries when working with clients. Staff members reported experiencing an identity shift in the role they see themselves play when working with clients, and subsequently a shift in their approach to working with their clients. Specifically, staff reported a nuanced approach to understanding clients' needs and providing tailored emotional support to their clients. Before the training, staff stated that they mainly stepped into the role of a friend and aimed to reduce the distress for the client and provide information. After training, staff were able to form a more professional identity to provide emotional support with a framework and a set of strategies in mind. The emotional intensity ladder, which, according to one staff member, served as a concrete guideline for him to assess the client's emotional status and teach appropriate skills. They reported intentional use of a combination of skills to understand clients' needs, help clients tolerate distress and regulate their emotions. They also applied the skills learned in training to regulate their own emotions (e.g.,

frustration, anger, sadness) that might get in the way of them providing emotional support for their clients.

> *It is important for us to regulate our own emotions to assist the clients in managing their emotions. An integrated approach, rather than a single method, should be used to help the visitors. I used to think that helping them meant making the visitors happy, but now it is realized that helping is not just about pleasing them, but also about establishing boundaries. The application, practice, and implementation of skills can promote growth in both me and my clients. (SCMC staff)*

Knowledge gain

Regarding specific skills, staff members mentioned the following content to be practical and easy to implement: emotion regulation skills (e.g., opposite action), validation, and distress tolerance skills. Staff members found validation and active listening beneficial for reducing frustration in both clients and themselves. Staff practiced using inquiry and empathy to facilitate contextual understanding before giving advice. Staff members also found distress tolerance skills (e.g., reduce body temperature, use five senses to soothe) to be practical strategies for clients with heightened emotional distress due to the recency of their diagnosis.

> *I will now consciously apply these techniques: patiently listening, giving clients space to express themselves without interrupting or being impatient, empathizing, comprehensively understanding, and validating clients' emotions and real-life experiences of fear and anxiety.* (*SCMC staff*)

> *I spent some time on the phone first trying to understand the client's main concern and emotional struggles. Instead of making suggestions right away, I asked a few more*

questions to know more about the client's day-to-day life and their hobbies. We made some plans together for the client to try to improve his mood. (SCMC staff)

Staff members expressed mixed feelings towards training materials on suicide screening and crisis intervention. While acknowledging the importance of this area of training, the majority of the staff found this aspect of client needs better suited for mental health professionals. The staff expressed concerns around being able to implement the screening and intervention with potential clients in crisis and would feel more comfortable with more focused and specialized training in this aspect. The staff members also expressed worries that screening for suicidality may increase their client's risk for suicide.

Suggestions

Overall, SCMC staff reported increased knowledge in the "what" (theories and concepts) and "how" (practical skills) of providing psychological support. The staff particularly appreciated the examples and role plays that demonstrated how the concepts and skills were relevant and could be applied to their life and their work with clients. The staff recognized the effects of training partially depended on the varying levels of mental health knowledge among the SCMC staff. They expressed willingness to participate in similar training and to recommend the training to their colleagues.

SCMC staff suggested the following aspects to be revised to further improve the training content. First, a brief introduction of the key theoretical underpinnings of cognitive behavior therapy could help staff to better understand why certain emotion regulation skills work. For example, knowing the cognitive triangle that illustrates how thoughts, emotions, and behaviors are interconnected could help staff understand that the opposite action skill leverages the

bidirectional link between behavior and emotions to induce change in emotions via behavioral change. Second, staff would like to have more training and practical guidance on increasing their awareness of their tendency to jump to advice-giving, knowing that this is a barrier to validating and empathetic interactions with clients. Third, given that the skills were taught independently of each other with examples tailored to each skill, the staff members would like to have more complex case scenarios where they could learn how to integrate the learned skills. Lastly, SCMC staff described a few topics that they would like to receive training on, including helping people with extreme fear of HIV/AIDS, disclosure of HIV status to loved ones, approaches to work with clients with low trust in SCMC staff, strategies to cope with frustration and burnout, and how to prevent and address sexual or flirtatious messages from their clients.

In terms of training logistics, staff would like to space out the training sessions to have more time to practice and consolidate skills covered in each session. Moreover, instead of doing role plays to practice skills during the training sessions, staff suggested leaving paired-up roleplay practice to be completed outside of the sessions. The benefits of doing this are two-fold: 1) saving time to cover more skills and their application in greater depth during sessions, and 2) offline/in-person roleplay practice might create a better learning experience with more nonverbal cues available.

Clinical outcomes

Intervention effects on clinical outcomes were reported below, including mental health outcomes, quality of life, and medication adherence outcomes.

Mental health

The PHQ-9 score decreased among the intervention group from baseline (M = 9.6, SD = 5.3) to end of intervention (M = 7.2 , SD = 4.7), while remained relatively the same for the control

group (baseline: M = 8.6, SD = 3.4; end of intervention: M = 8.3, SD = 4.0). The GAD-7 score decreased in both intervention and control group from baseline to end of intervention. (Table 8)

Time was associated with a greater decrease in PHQ-9 and among the intervention group, compared to the control group (β = -0.73, 95%CI [-1.37 -0.10]). (Table 9)

Quality of life

The overall quality of life score increased for the intervention group from baseline (M = 129.6, SD = 19.2) to endline (M = 133.0, SD = 23.0), compared to the decrease for the control group from baseline (M = 133.2, SD = 19.7) to endline (M = 128.9, SD = 19.2). The scores on the subscales of QoL measure stayed relatively the same for both control and intervention groups (Table 10).

The LMM results suggested that time was associated with less decrease in quality of life among the treatment group, compared to the control group. However, this interaction was not significant (β = 1.93, 95%CI: -0.97 – 4.84). (Table 11) Specifically, the subscale of HIV mastery score (β = 0.37, 95%CI: 0.01 – 0.74) and life satisfaction (β = 0.85, 95%CI: 0.11 – 1.59). increased over time among the intervention group compared to the control group. (Appendix 3)

Medication adherence

Both control and intervention group participants reported close to 99% adherence rate for the past 30 days (Table 10). The control group showed slight variations between baseline and endline on how well (baseline: M = 75.6, SD = 21.6; endline: M = 72.6, SD = 25.0) and how often (baseline: M = 86.3, SD = 12.5; endline: M = 83.2, SD = 21.2) they followed the instructions to take their medication. The intervention group participants, however, reported

increased scores between baseline and endline for both how well (baseline: M = 80.2, SD = 19.0; endline: M = 90.1, SD = 16.9) and how often (baseline: M = 88.7, SD = 12.8; endline: M = 92.9, SD = 9.8) they followed the instructions to take their medication. (Table 12)

The LMM results suggested that time was associated with more increase in adherence score (β = 0.18, 95%CI: -0.04 – 0.41) among the treatment group, compared to the control group. However, these interactions were not significant. (Table 13)

Potential mechanisms of change/Intermediate outcomes

Difficulties in emotion regulation

The control group self-report on difficulties with emotion regulation stayed similar between baseline (M = 39.8, SD = 9.7) and endline (M = 41.6, SD = 9.7). In contrast, the intervention group self-reported difficulties with emotion regulation decreased from baseline (M = 43.6, SD = 10.4) to endline (M = 37.8, SD = 11.8). (Table 14)

The LMM results suggested that time was associated with a greater decrease in difficulties with emotion regulation among the treatment group, compared to the control group. However, this interaction was not significant (β = -1.56, 95%CI: -2.72 – -0.41). (Table 15) Specifically, the intervention group showed a greater decrease in non-acceptance of emotions (β = -0.48, 95%CI: -0.88 – -0.09) and emotion interference on goals (β = -0.37, 95%CI: -0.72 – -0.03) compared to the control group.

Coping self-efficacy

The self-reported coping self-efficacy remained relatively the same between baseline and endline for the control group (baseline: M = 92.3, SD = 21.3; endline: M = 92.8, SD = 16.1), while

increased for the intervention group (baseline: M = 92.1, SD = 23.7; endline: M = 97.3, SD = 30.8). (Table 15)

The LMM results suggested that time was associated with a greater increase in coping self-efficacy related to emotions (β = 0.97, 95%CI: 0.06 – 1.88) and seeking support from family and friends (β = 0.82, 95%CI: 0.08 – 1.57) among the treatment group, compared to the control group. (Appendix 3)

HIV-related stigma

The scores of HIV-related stigma stay relatively the same across baseline and endline for control and intervention groups (Table 16)

The LMM results suggested that time was associated with a greater increase in HIV-related stigma among the treatment group, compared to the control group. However, this interaction was not significant (β = 0.02, 95%CI: -1.46 – 1.50). (Table 17) Overtime, both control and intervention groups showed decrease in perceived public negative attitude towards PWH (β = -0.29, 95%CI: -0.45 – -0.12). (Appendix 3)

Discussion

This feasibility pilot study used a mixed methods design to examine the feasibility, acceptability, and usability of a 4-week DBT-based mHealth intervention that aimed to enhance coping and mental health outcomes among MSM living with HIV in China. The overall perceived feasibility, acceptability, and usability was high among the intervention users, with a few areas that need further improvement. The qualitative findings obtained from interviews with intervention users and SCMC staff was complementary to the quantitative surveys. The mixed methods approach provided valuable insight to inform the further improvement of the intervention program. The preliminary results suggested promising intervention effects on improving depressive symptoms, sense of mastery over living with HIV, and overall life satisfaction. We also found changes in intermediate outcomes including decrease in emotional regulation difficulties and increase in coping self-efficacy.

Intervention feasibility

Both quantitative and qualitative data suggested high perceived intervention feasibility. The overall three-component structure of the intervention was well received by the participants in the intervention group. Participants perceived the components of the intervention to be complementary, as intended by the intervention design guided by the COM-B model (see Chapter 2.) Consistent with the literature, participants perceived the group-based skills learning element in the intervention as serving accountability check, shared goal setting, and an environment for peer support and bonding, all of which increased participants' motivation to continue to engage with the app (Fortuna et al., 2019). Privacy and confidentiality concerns were initially indicated to be potential barriers to participation in the group based on needs assessment

interview (See Chapter 1.) and previous literature on peer group intervention strategies (Ronen et al., 2020). However, participants reported feeling safe in the group and felt comfortable engaging in group learning, suggesting that these concerns were adequately addressed through multiple strategies, including acknowledging the concern to group members, setting group guidelines in the first group, and having SCMC staff restate the rules at the beginning of each weekly group session.

Time commitment emerged as the main challenge for intervention feasibility. Participants expressed concerns around balancing online skills groups and their work schedules for similar interventions in the future. This is a common challenge in psychosocial interventions, with most intervention programs lasting multiple weeks or months and could be burdensome for study participants, which may impact intervention effectiveness (van Luenen et al., 2018). One possible reason that time constraint stood out as a challenge in this study might be because most of the study participants were young adults (aged 23-35) who were facing significant work stress while navigating the health system to accessing HIV-related services. Moreover, our study was conducted in Shanghai, a metropolitan and the economic center of China that attracts a large number of internal migrants, whose livelihood and access to healthcare and social benefits (Wang et al. 2019). Moreover, working overtime is also a norm in Shanghai, a metropolitan and economic center of China (Li et al., 2019). Nevertheless, the time demand of the intervention program could be further reduced with more efficient management of group time and shorted podcasts as suggested by some participants. For example, further improvement of this intervention can use 2-3 min didactics so the intervention users could fit this into their tight schedule and absorb more information. Indeed, a recent study found brief narrated animated DBT skills videos (each 2-5 minutes long) were effective in reducing psychological distress and

increasing in distress tolerance among college students during COVID-19 pandemic over six weeks of study period (Rizvi et al., 2022).

Intervention acceptability

The intervention acceptability was high, with a few areas that need further improvement. Participants would also like to see a wider range of topics covered in the podcasts with more relatable stories and examples of how certain DBT skills can be used in day-to-day life. Indeed, intervention content that was relatable to the users was perceived to have higher acceptability (Madkins et al., 2019). Similarly, literature on peer role modeling and behavior found that peer modeling intervention was more effective when the role models were perceived as similar to the participants. (Rowland et al., 2018).

Participants were satisfied with the support from SCMC staff and found the staff to be empathetic, genuine, and warm during the group. They found the skills group environment to be a safe space for them and expressed high willingness to participate in future intervention programs, especially the group component. Although group relationships were not explicitly stated as an active ingredient of DBT skills training, studies demonstrated that positive group dynamics (e.g. group cohesion, emotional bond, and empathy) was associated with a higher level of adaptive emotional functions (Burlingame et al., 2018). In addition to cultivating supportive relationships among members, the DBT-informed group also brings the benefits of a clear structure, agenda setting, goal-oriented discussion and peer learning centered around skills (Linehan, 1993).

App usability

The simple and intuitive design of the app enabled the user to navigate the app with ease. The usability of the app was acceptable as suggested by SUS, was above the benchmark SUS has been widely used for digital products and systems and validated for measuring the usability for digital health apps. Inferior usability could present as a barrier for adoption of digital health technologies, while higher usability increases user engagement and thus allow users to maximize potential benefits. User engagement with hybrid behavior intervention often hinges on the engagement with the digital technology, which includes both engagement with the interface and the intervention content delivered on the digital technology (Cole-Lewis et al., 2019). Although digital health literature on user experience such as user engagement and usability has been growing, there is a lack of quantitative evidence that directly supports the association and causal relationship between factors such as app usability and user engagement. One such study on mHeath apps for patients with breast cancer found that the participants who rated the app with higher usability score also tended to report more commitment for physical activity, indicating higher engagement with the intervention content on physical activity (Ebnali et al. 2019). The heterogeneity in the definition and measurement of engagement presents challenges in quantifying and qualifying the factors that influence user engagement with digital health apps. The majority of studies measure engagement at a descriptive level that reduces engagement to retention, adherence, or completion, by measuring frequency of user logins, number of clicks, and duration of interaction with the app (Amagai et al. 2022). Studies often also focuses on individual and intervention level factors and lacks a contextual view of engagement behavior (O'Brien et al. 2020). Informed by the COM-B model, our intervention aimed at enhancing engagement and specifically targeted at the capability, motivation, and opportunity for

behavioral change at individual level through peer and community level intervention approaches (see Chapter 2). Future research can continue to leverage contextual factors to enhance engagement by strengthening multi-level constructs/factors, such as self-efficacy, habit building, and social opportunities for behavior change (Lipschitz et al. 2023). The field of digital health intervention research will benefit from development of a multidimensional framework of engagement (emotional, cognitive, and behavior engagement) and examining engagement in meaningful behavior changes aligned with intervention goals that go beyond in-app behaviors.

Training feasibility and acceptability

The training component of our intervention overall was acceptable and feasible, indicated by the self-reported knowledge and skills gain reported by staff members and overall positive feedback from intervention group participants. The training design benefited from having a comprehensive curriculum that covered both foundational and intervention specific skills that prepared the staff members for facilitating the groups as well for their daily work at the organization. Indeed, foundational skills such as validation and active listening and problem solving are widely supported by literature as general skills that facilitate rapport building, which is the catalyst for effective intervention delivery (Qina'au and Masuda 2020). In addition, studies tend to not specifically describe the role of trained lay counselors in the intervention, which presents challenges in determining whether the amount of training was adequate for their designated role (Connolly et al. 2021; Mendenhall et al. 2014). The training materials in this intervention were carefully composed in consultation with DBT experts to tailor to their role as skill group facilitators and on-demand skill coach. Literature on lay provider training continues to call for role specification which may both facilitate training goals and supervision targets as well as help lay providers understand their expectations and intentionally cultivate skillful behaviors through

the training (Barnett et al. 2023). As literature has been growing in supporting the effects of lay provider training, within interventions that involve lay provider training, it would be important to provide ongoing evaluation and assessment both during training and intervention period, to consolidate staff competencies (Raviola et al. 2019). Literature suggested that evaluation can enhance lay provider confidence and motivation, inform supervision strategies, and increase fidelity of intervention delivery (Bond et al. 2022). Although this study did not conduct formal evaluation using quantitative measures, staff readiness for intervention was assessed using post training interviews and staff performance was continuously observed and enhanced through weekly supervisions (Shahmalak et al. 2019). Given the nuanced nature of the roles lay providers are expected to play in different interventions, future studies may consider developing and tailor evaluation and assessment rather than adopting a one size fit all approach.

Training on suicide screening and crisis intervention elicited heated discussion among SCMC staff. The major concern was that asking client's suicidal ideation or self-harm behaviors would increase clients' likelihood of attempting suicide. This is a common myth held among the public, including mental health professionals who did not receive related training or routinely work with suicidal clients (Joiner, 2011). However, several studies and a meta-analysis did not support the iatrogenic effects of universal suicide screening programs (DeCou & Schumann, 2018; Gould et al., 2005). Although the staff reported that they gained familiarity with the suicide crisis protocol, they still felt uncomfortable to approach this topic with high-risk clients. Similar studies conducted in low mental health resource settings found high acceptability of risk assessment training among non mental health professionals, where participants reported growth in assessment of suicide risk, reduce stigma around discussing suicide, and engaging adolescents at risk (Alonzo et al. 2021). Compared to our study, the 2-day training on suicide assessment in

Alonzo's study was more concentrated and given the local context of high rates of domestic violence and childhood physical and sexual abuse in the Guatemala community, participants were more aware of the high risk the adolescents were at and thus found the training to be more relevant and highly acceptable. This is reasonable given the limited mental health training they have received so far, the low base rate of suicide attempts, and the stigma related to suicide and parasuicide behaviors (Gearing et al., 2023; Qiao et al., 2022). We could not locate interventions conducted in China that involved suicide risk assessment training for lay providers. More work is needed to enhance the understanding of suicidal and parasuicidal behaviors among lay providers in China. As a workforce in the forefront when providing psychosocial support, the knowledge and skills in handling crisis situations will help the SCMC staff overcome the fear around screening for suicidality, which is the ubiquitous barrier to subsequent assessment and linkage to higher levels of psychiatric care for high-risk individuals.

Clinical outcomes and intermediate outcomes

Given the difficult emotions at initial HIV diagnosis and the coping with challenges that arise in living with HIV in the community (See Chapter 1), this intervention targeted the difficulties in emotion regulation and coping as potential mechanisms of change. The findings supported our hypothesized mechanism of action for the intervention. Participants in the intervention group gained skills and self-efficacy in coping with emotional distress, and over time expressed fewer depressive symptoms and experienced increased control of life living with HIV, and consequently experienced increased life satisfaction. Indeed, previous studies supported the effectiveness of DBT skills training groups on improving depression symptoms (Blackford & Love, 2011), emotion regulation (Heath et al., 2021), behavioral dysregulation, and global psychosocial functioning (Valentine et al. 2015).

The quality-of-life measure used in this study captured a number of dimensions, where intervention group participants showed improvement in HIV mastery and overall life satisfaction across the 4-week intervention period. Of note, these dimensions were not direct targets of this intervention. Even though quality of life is also a more distal outcome that typically requires longer and more comprehensive intervention programs to observe statistically and clinically significant change (Kan et al., 2020; Oliveira et al., 2020). Nevertheless, we observed positive effects of intervention on quality of life among intervention group participants, potentially due to the improvements in depressive symptoms and overall emotional distress (Brandt et al. 2017).

The engagement with the intervention materials and skills group may also have contributed to the promising effects we observed in the clinical outcomes. The majority of the intervention group participants self-reported that they completed podcasts before weekly skills groups, and the completion was further verified by the research team using the backend data. Of note, the study obtained promising intervention effects despite the fact that the participants in the intervention group scored higher across clinical outcomes compared to the control group. Some participants from the intervention group might have a history of undiagnosed mental disorders, which required a higher level of care including psychiatric medication and long-term therapy (Nordmo et al., under review). For these participants, the intensity of this intervention might not be enough to produce any meaningful change in their mental health outcome within the 4-week study period.

Participants in both control and intervention groups were highly adherent, with no missing dosage reported for the past 30 days. Although not significant, the intervention group seemed to follow the instructions to take their medications better and more often throughout the study period, compared to the control group. Difficult emotions post-HIV diagnosis often lead to

maladaptive coping and avoidance of treatment engagement, negatively impacting medication adherence (Boretzki et al., 2017; Katz et al., 2013). Thus, this intervention could potentially reduce avoidance and improve adherence outcome by increasing the skills to regulate their emotions and maintain goal-oriented behavior rather than emotion-driven behaviors.

Although this intervention did not directly target HIV-related stigma, previous studies suggested that connections and peer support from the community with other individuals living with HIV could reduce internalized HIV-stigma (Abubakari et al., 2021; Denison et al., 2020; Reif et al., 2021). Participants in both groups in this study reported a decrease in perceived HIV-related stigma from the public. This could be a natural trajectory over time where individuals gradually gravitate towards social groups where they experience the least amount of stigma. This could also be a result of being part of the study, where they were in touch with the research team who regularly contacted them with a warm and validating manner. Nevertheless, participants in the study exit interview frequently mentioned stigma as a topic that they are interested in adding to the skills group discussion. Abundant evidence suggests that internalized HIV-related stigma could interact with the external enacted stigma and negative social attitudes and lead to worse mental health and adherence outcomes (Sweeney & Vanable, 2016). Future iterations of this intervention will include stigma as a target and adopt intervention approaches from the COM-B model to mitigate the adverse effects of stigma on mental health.

Limitations

This is the first DBT-based mHealth intervention feasibility pilot study that targets the emotional difficulties among MSM living with HIV to enhance their coping skills, mental health and medication adherence. First, all study procedures were conducted fully online due to the ongoing

COVID-19 pandemic, which could be the cause of the initial recruitment difficulties. The training with SCMC staff and skills groups might have been more engaging if conducted in person. However, study participants also reported finding the online format to be convenient and less time consuming compared to in-person groups. Another benefit of online groups was privacy protection, which allows the participants to stay off camera and use pseudonyms. Second, the technical difficulties due to the instability of the app might have caused frustration for the users. Future iterations of the app will focus on addressing the technological delivery so that the intervention users will be able to focus on the content. Last, this is a feasibility pilot trial with a relatively small sample size, the results of which warrants larger trials to further examine its effectiveness.

Conclusion

This pilot study demonstrates the feasibility and acceptability of a multi-component DBT-based mHealth intervention for improving mental health and medication adherence among MSM living with HIV in China. The intervention was perceived as supportive, safe, and engaging. Preliminary data indicated improvements in depression, quality of life, emotion regulation, and coping self-efficacy, though a larger sample size is needed to confirm these effects. The study's strengths lie in its mixed-method approach and community-engaged design, which enhanced the intervention's contextual fit. By addressing multi-level barriers and leveraging community resources, the intervention facilitated individual coping skills learning. Future research will focus on refining the intervention's feasibility and acceptability, increasing the sample size to examine effectiveness, and exploring its potential for broader implementation in HIV care for MSM in China.

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Tables and Figures

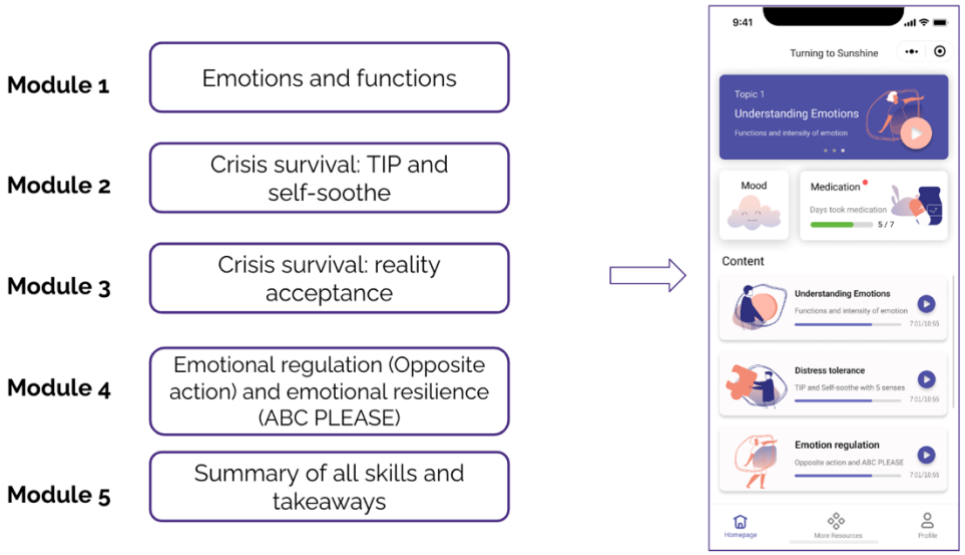
Table 1. A brief overview of module content and outline

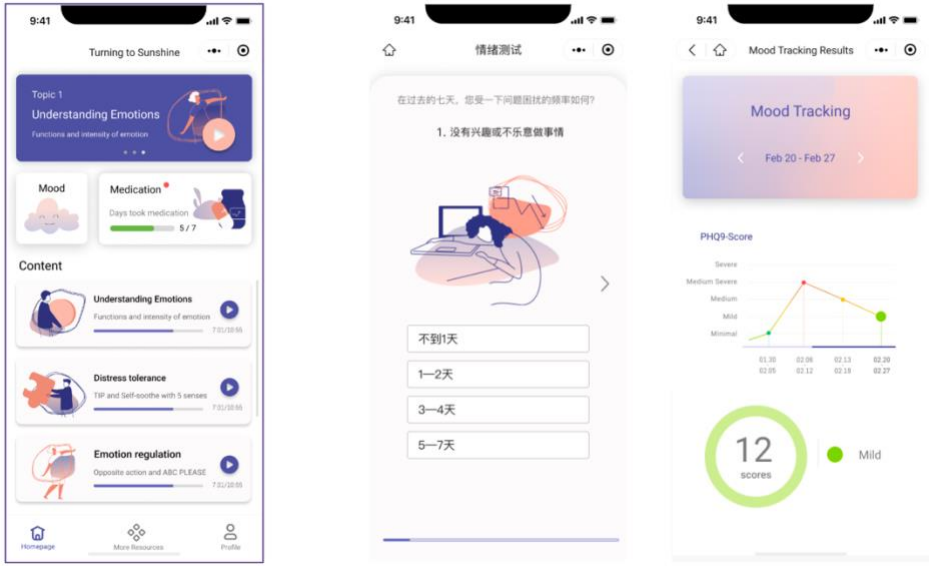
Module	Title	Description	DBT concepts/skills
Module 1	*Emotions, monsters or friends?* Get to know different emotions, intensity, and function of emotions	Psychoeducation about functions of emotions, the impact of emotions on behaviors, myths of emotions, emotional intensity (covered in group)	Noticing and validating one's own emotions is the first step towards understanding and accepting emotions and the role they play in guiding our behaviors and achieving our goals. Emotion intensity ladder: observing emotional intensity and being able to decide what skills to use for a given situation depending on the goal. Skills breakdown point is when the emotion intensity reaches a high point that beyond this point individuals are at high risk for emotion-driven impulsive behaviors. Observing skills breakdown points can allow individuals to use distress tolerance skills to get through intense emotions.
Module 2	*Pain is inevitable; we'll get through this together.* Tolerate pain at the moment without making things worse	Define crisis situations, introduce the appropriate situations to use distress tolerance skills (vs. problem solving skills) to make a painful situation more tolerable so that individuals are less likely to act impulsively and make the situation worse.	STOP: The STOP skill helps individuals refrain from impulsive actions. STOP is a mnemonic for the folowing steps: Stop, Take a step back, Observe, and Proceed mindfully. Pros and Cons: List out the pros and cons of acting on impulses and not acting on impulses (distress tolerance) to facilitate better decision making

			TIP: Change body chemistry quickly to counteract disabling emotional arousal. TIP is a mnemonic for Temperature, Intense exercise, Paced breathing, and Paired muscle relaxation. Self-soothe: Use activities that focus on five senses: vision, hearing, smell, taste, and touch. To comfort, nurture, and soothe.
Module 3	*Acceptance sometimes is more difficult than change* Accept reality to release suffering and get unstuck	Radical acceptance aims to reduce suffering and increase freedom when painful facts cannot be changed immediately. Explain what is radical acceptance, what to accept, why radical acceptance is important, skills to use to practice acceptance.	Turning the mind: When the reality is difficult to accept, it takes repeated attempts over an extended period of time to reach acceptance. Turning the mind is to choose to accept reality when noticing resistance and denial from inside. Half smiling: Relaxing facial muscles with lips slightly upturned at the corners, indicating willingness. Willing hands: Hands are unclenched, palms open and up, fingers relaxed, indicating acceptance vs. fight with resistance. Both half-smiling and willing hands are skills to practice accepting reality with one's body.
Module 4	*We are in control of emotions, not the other way around* Regulate emotions and reduce vulnerability to	Emotions can lead to behaviors that are not aligned with our goals. To reach our goals short term and long term, we need to acknowledge the power of emotions over us and actively regulate these emotions to regain control over our behavior.	Opposite action: Act in a way that opposes or is inconsistent with the emotion can help change the emotions by changing its action and how it's expressed. ABC PLEASE: to reduce emotion vulnerability and increase emotional resilience. • Accumulate positive emotions: Increasing the number of pleasurable events in the short term and building a life worth living in the long term are two ways to increase positive emotions in one's life.

	extreme emotions	Emotional resilience can grow from practicing skills to reduce the intensity of our emotions and the likelihood of experiencing extreme emotions.	• Building mastery: engage in activities that build a sense of self-efficacy, self-control, competency • Cope ahead: learn to cope ahead of time with difficult situations using imaginal rehearsal • PLEASE: physical illness, eating, avoid drugs, sleep, exercise
Module 5	*Practice makes perfect* Consolidate learning by practicing the skills learned	Summary of the three categories of skills: distress tolerance, reality acceptance, emotion regulation.	Summary of all skills covered in the previous four modules. Outline key takeaway points/principles: • Practice in diverse situations to enable skills generalization • Use a combination of skills to flexibly cope with situations • Problem solve when skills are not working • Balance between acceptance and change, emotion and reasoning.

Table 2. Main app features

Homepage and podcasts	

Depression tracking using PHQ9	

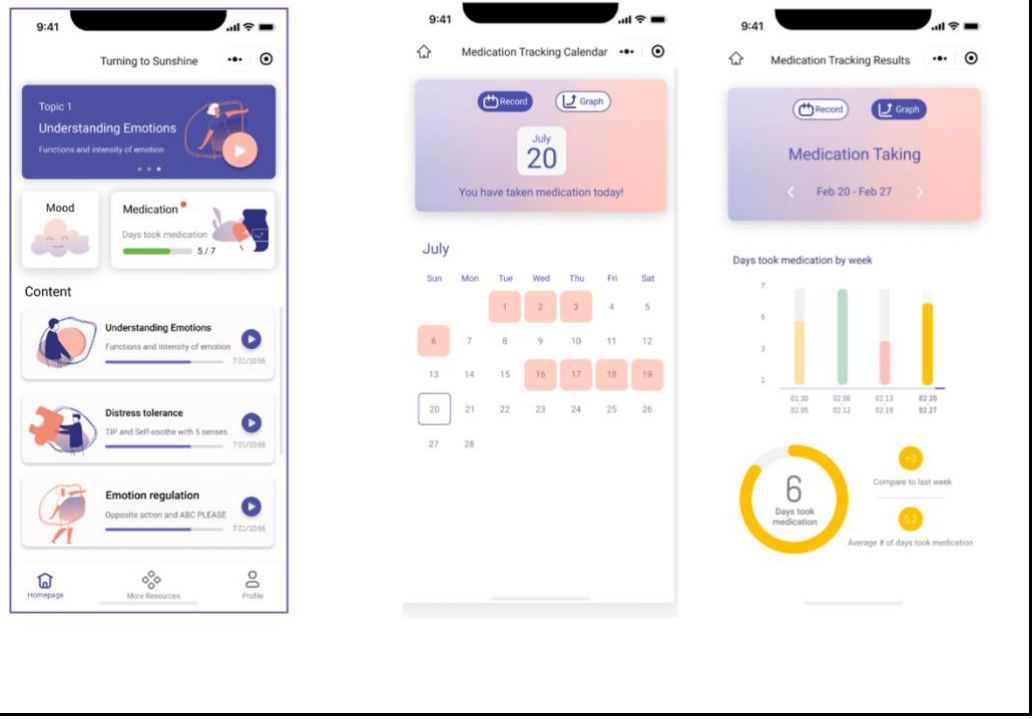
Medication tracking calendar	

Table 3. Feasibility and acceptability outcomes and measures1

Outcome	**Evaluation**
Recruitment, enrollment, retention rates	• Survey completion rates out of the number of individuals contacted by SCMC staff to invite to participate in the study • Percentage of screened individuals who fulfilled inclusion criteria; • Percentage of enrolment (out of those who were screened) after study onboarding • Ambiguities and operationalization of eligibility criteria • Reasons for ineligibility • Reasons for non-participation, despite being eligible

Data collection procedures and measure	• Wording and clarity of the measure items • Participant burden due to number of measures • Number of missing items within each measure
Attrition	• Rates of study dropout • Rates of intervention dropout • Reasons for study and intervention withdrawal • Reasons for group absence, incomplete measures
Participants use and adherence of intervention	• Completion of materials on app, group attendance, phone coaching use • Adherence to group guidelines • (Optional) medication and depression tracking, guided meditation
SCMC staff adherence to intervention	• Adherence of group structure • Enforcement of group guidelines • Delivery of content and demonstrated skills
*Overall intervention feasibility and acceptability (intervention user)	Qualitative interview • Acceptability: expectation of the study, key take-aways, changes in self-efficacy, perceived ability in coping with difficult emotions, intervention (podcast) content, online skill group structure and content, SCMC staff capability, and willingness to participate in future revised intervention, willingness to recommend the intervention to others • Feasibility: overall intervention duration and structure, burden caused by intervention, measures, and interviews. Quantitative measure • Acceptability and feasibility measure adapted from (Dorsey et al. 2019)
*Overall intervention feasibility and acceptability (SCMC staff)	Qualitative interview • Acceptability: key take-aways, changes in self-efficacy, perceived ability in providing mental health support, training content, instructor capability, and willingness to participate in future training. • Feasibility: overall training duration and structure, burden caused by training, and institutional support around training.

1. The items marked * were reported in the text, while the rest will be calculated and reported once the study is completed.

Table 4. Qualitative analysis steps

Approach	Steps	Details
Deductive	Develop categorization matrix	Main categories and subcategories were identified from stress and coping framework and socio-ecological framework and formed a categorization matrix.
Inductive	Consensus/Open coding	Data was coded based on complete ideas. In this stage, codes were generated by reading through two transcripts. Categories were freely generated, with the main categories in mind: stress, coping, outcome.
Inductive	Coding sheets/Grouping and categorization	The codes and categories were collected and organized in a spreadsheet and compared with the categorization matrix derived from the theoretical framework.
Deductive + inductive	Adjust structural analysis matrix	The categorization matrix was modified to take in the codes and categories generated from the data and formed a codebook.
Inductive	Independent coding	The first and second author coded the rest of the transcripts using the codebook.
Deductive + inductive	Corroborating and legitimating code and categories	The first author examined the categories, sub-categories, and codes to ensure that the codebook represents the data accusatively.

Table 5. Demographics of study participants

	Control (N=14)	Intervention (N=16)	Total (N=30)	p value
Age				0.456[1]
Mean (SD)	30.9 (9.7)	28.8 (5.1)	29.7 (7.6)	
Range	23.0 - 61.0	23.0 - 41.0	23.0 - 61.0	
Age (category)				0.942[2]
N-Miss	1	3	4	
<= 30	8 (62%)	9 (69%)	17 (65%)	
30-35	2 (15%)	2 (15%)	4 (15%)	
35-40	2 (15%)	1 (8%)	3 (12%)	
> 40	1 (8%)	1 (8%)	2 (8%)	
Ethnicity				0.922[2]
Han	13 (93%)	15 (94%)	28 (93%)	
Other	1 (7%)	1 (6%)	2 (7%)	
Education				0.212[2]
High school	2 (14%)	0 (0%)	2 (7%)	
Vocational school	3 (21%)	4 (25%)	7 (23%)	
College	6 (43%)	11 (69%)	17 (57%)	
Master or above	3 (21%)	1 (6%)	4 (13%)	
Monthly income (RMB/USD)				0.290[2]
No income	2 (14%)	3 (19%)	5 (17%)	
2000~4999 / 276~688	1 (7%)	1 (6%)	2 (7%)	
5000~7999 / 723~1157	6 (43%)	2 (12%)	8 (27%)	
>8000 / >1157	5 (36%)	10 (62%)	15 (50%)	
Employment status				0.586[2]

	Control (N=14)	Intervention (N=16)	Total (N=30)	p value
Student	1 (7%)	2 (12%)	3 (10%)	
Unemployed	2 (14%)	1 (6%)	3 (10%)	
Employed	10 (71%)	13 (81%)	23 (77%)	
Retired	1 (7%)	0 (0%)	1 (3%)	
Hukou (residential status)				0.544[2]
No	11 (79%)	11 (69%)	22 (73%)	
Yes	3 (21%)	5 (31%)	8 (27%)	
Local residential permit				0.362[2]
N-Miss	0	1	1	
No	7 (50%)	10 (67%)	17 (59%)	
Yes	7 (50%)	5 (33%)	12 (41%)	
Sexual orientation				0.351[2]
Bisexual	1 (7%)	3 (19%)	4 (13%)	
Homosexual	13 (93%)	13 (81%)	26 (87%)	
Marital status				0.637[2]
Single	10 (71%)	10 (62%)	20 (67%)	
With stable partner	2 (14%)	4 (25%)	6 (20%)	
Married	1 (7%)	0 (0%)	1 (3%)	
Divorced	1 (7%)	1 (6%)	2 (7%)	
Other	0 (0%)	1 (6%)	1 (3%)	
Time since diagnosis (Months)				0.508[1]
Mean (SD)	44.1 (46.8)	33.2 (42.2)	38.3 (44.0)	
Range	3.0 - 168.0	4.0 - 138.0	3.0 - 168.0	

1. Linear Model ANOVA
2. Pearson's Chi-squared test

Table 6. Demographic characteristics of SCMC staff

	SCMC staff (N = 6)
Age	
Mean (SD)	36.7 (5.6)
Range	28.0 – 41.0
Sex	
Male	6 (100%)
HIV duration (Months) (n = 3)	
Mean (SD)	123.3 (19.3)
Range	101.0-135.0
Work Duration (Years)	
Mean (SD)	5.3 (4.0)
Range	2 - 13
Ethnicity	
Han	5 (83.3%)
Other	1 (16.7%)
Education	
Professional School	2 (33.3%)
College	3 (50.0%)

Graduate or Above	1 (16.7%)
Monthly income (RMB)	
2000~4999 (290 ~ 723 USD)	1(16.7%)
5000~7999 (723~1157 USD)	1 (16.7%)
≥8000 (>1157 USD)	4 (66.7%)
Employment	
Yes	5 (83.3%)
No	1 (16.7%)
Local Hukou	
Yes	3 (50%)
No	3 (50%)
Local Permit (n = 3)	
Yes	1 (66.7%)
No	2 (33.3%)
Sexual orientation	
Gay	15 (100.0%)
Marital Status	
Unmarried & Single	3 (50.0%)
Unmarried & partnered	2 (33.3%)

Married	1 (16.7%)

Note: All 6 SCMC staff participated in training, while 2 are currently leading online skills groups.

Table 7. Intervention feasibility, acceptability, and system usability outcome (n = 16)

Variables	Items	Mean	SD	Range
Feasibility				
feasi1	I have enough time for all the activities that go into learning the skills and participating in the online groups.	4.2	0.9	2.0 - 5.0
feasi2	I have enough time to spend in activities learning the skills/ leading the skills group	4.5	0.6	3.0 - 5.0
feasi3	I have the right equipment to participate in this study (e.g., laptop, smartphone).	4.9	0.3	4.0 - 5.0
feasi4	I have the resources (e.g., phone, wechat) to reach SCMC staff in between sessions when needed	4.6	0.6	3.0 - 5.0
feasi5	I am able to reach my SCMC for emotional support when needed	4.6	0.6	3.0 - 5.0
feasi6	Average hours per week on learning the skills and participate in online group are manageable.	4.6	0.5	4.0 - 5.0
Acceptability[1]				
accept1	I liked learning the skills introduced through this intervention.	4.4	0.5	4.0 - 5.0

accept2	I felt good about learning the content on the app	4.1	0.7	3.0 - 5.0
accept3	I continue to enjoy learning the skills.	3.9	1.1	1.0 - 5.0
accept4	I felt that the skills I learned made sense to me	4.5	0.5	4.0 - 5.0
accept5	I was satisfied with the support I received from SCMC staff when I was learning the skills.	4.8	0.4	4.0 - 5.0
csq1	How would you rate the quality of service your received?	4.6	0.5	4.0 - 5.0
csq2	To what extent has the program met your needs?	4.2	0.9	2.0 - 5.0
csq3	Have the services you received helped you to deal more effectively with your difficulties related to emotions?	4.5	0.5	4.0 - 5.0
csq4	If you were to need mental health related service, would you use our program (app + group)?	4.5	0.5	4.0 - 5.0
csq5	If a friend were in need of similar help, would you recommend our program to him/her?	4.4	0.7	3.0 - 5.0
csq_total		22.2	2.4	18.0 - 25.0
App usability				
sus1	I think that I would like to use this system frequently.	2.9	1.2	0.0 - 4.0
sus2	I found the system unnecessarily complex.	2.4	1.2	0.0 - 4.0
sus3	I thought the system was easy to use.	3.3	0.8	1.0 - 4.0

sus4	I think that I would need the support of a technical person to be able to use this system.	2.7	1.2	0.0 - 4.0
sus5	I found the various functions in this system were well integrated.	2.9	1.0	0.0 - 4.0
sus6	I thought there was too much inconsistency in this system.	2.5	1.1	0.0 - 4.0
sus7	I would imagine that most people would learn to use this system very quickly.	3.5	0.6	2.0 - 4.0
sus8	I found the system very cumbersome to use.	3.0	1.0	0.0 - 4.0
sus9	I felt very confident using the system.	2.8	1.0	0.0 - 4.0
sus10	I needed to learn a lot of things before I could get going with this system.	3.2	0.9	2.0 - 4.0
sus_total[2]		73.1	15.9	40.0 - 100.0

1. The first five items are adapted from (Dorsey et al., 2019), and the rest were from Client Satisfaction Questionnaire (Larsen et al. 1979).
2. SUS total score was calculated following the scoring rules (Brooke, 1995). The sum of the scores of all items was multiplied by 2.5 to obtain the overall value of SUS (0-100). The threshold of an average SUS is 68.

Table 8. Mental health outcomes

	Control							Intervention						
	Baseline (n=14)	Week 1 (n=14)	Week 2 (n=14)	Week 3 (n=14)	Week 4 (n=14)	Total	p^1	Baseline (n=16)	Week 1 (n=15)	Week 2 (n=15)	Week 3 (n=16)	Week 4 (n=16)	Total	p^1
PHQ9							0.906							0.351
Mean (SD)	8.6 (3.4)	7.6 (3.3)	7.6 (3.0)	8.1 (2.8)	8.3 (4.0)	8.0 (3.3)		9.6 (5.3)	8.8 (6.0)	8.0 (7.0)	5.7 (2.7)	7.2 (4.7)	7.9 (5.4)	
Range	4.0 - 16.0	3.0 - 15.0	2.0 - 14.0	5.0 - 17.0	3.0 - 20.0	2.0 - 20.0		2.0 - 18.0	0.0 - 22.0	0.0 - 27.0	1.0 - 10.0	2.0 - 20.0	0.0 - 27.0	
GAD7							0.881							0.603
Mean (SD)	8.1 (4.2)	7.1 (4.2)	7.2 (3.9)	6.6 (3.6)	7.1 (3.0)	7.2 (3.7)		7.1 (4.9)	5.8 (3.8)	5.9 (5.4)	4.4 (3.2)	5.7 (4.7)	5.8 (4.4)	
Range	1.0 - 19.0	0.0 - 18.0	2.0 - 15.0	0.0 - 16.0	0.0 - 14.0	0.0 - 19.0		0.0 - 15.0	0.0 - 13.0	0.0 - 18.0	1.0 - 11.0	0.0 - 18.0	0.0 - 18.0	

1. Linear Model ANOVA

Table 9. LMM results on PHQ-9 and GAD-7. updated

	PHQ-9			GAD-7		
Predictors	*β*	*CI*	*p*	*β*	*CI*	*p*
(Intercept)	8.13	5.67 – 10.58	<0.001	8	5.76 – 10.24	<0.001

timepoint	-0.03	-0.49 – 0.43	0.903	-0.26	-0.60 – 0.09	0.143
tx	2.05	-1.32 – 5.41	0.231	-1	-4.07 – 2.06	0.519
timepoint:tx	-0.73	-1.37 – -0.10	**0.024**	-0.17	-0.64 – 0.31	0.492
Random Effects						
σ^2	7.64			4.26		
$\tau 00_{pid}$	13.19			13.26		
ICC	0.63			0.76		
N_{pid}	30			30		
Observations	148			148		
Marginal R^2 / Conditional R^2	0.029 / 0.644			0.044 / 0.768		

Table 10. Quality of Life

Subscales	**Control group**				**Intervention group**			
	Baseline (N=14)	Endline (N=14)	Total (N=14)	*p*[1]	Baseline (N=16)	Endline (N=16)	Total (N=32)	*p*[1]

Total				0.559			0.655
Mean (SD)	133.2 (19.7)	128.9 (19.2)	131.0 (19.2)		129.6 (19.2)	133.0 (23.0)	131.3 (20.9)	
Range	104.0 - 171.0	104.0 - 171.0	104.0 - 171.0		94.0 - 168.0	98.0 - 180.0	94.0 - 180.0	
Overall function				0.873			0.973
Mean (SD)	27.2 (4.1)	26.9 (5.2)	27.1 (4.6)		26.2 (5.3)	26.2 (5.0)	26.2 (5.0)	
Range	18.0 - 32.0	19.0 - 34.0	18.0 - 34.0		16.0 - 33.0	17.0 - 34.0	16.0 - 34.0	
Sexual function				0.772			0.890
Mean (SD)	9.1 (2.5)	8.9 (2.6)	9.0 (2.5)		8.9 (2.6)	9.0 (2.4)	8.9 (2.5)	
Range	5.0 - 13.0	4.0 - 13.0	4.0 - 13.0		3.0 - 13.0	6.0 - 13.0	3.0 - 13.0	
Disclosure worries				0.961			0.956
Mean (SD)	9.6 (3.6)	9.7 (4.0)	9.7 (3.7)		10.9 (6.2)	10.8 (6.5)	10.8 (6.2)	
Range	5.0 - 17.0	5.0 - 17.0	5.0 - 17.0		6.0 - 25.0	5.0 - 23.0	5.0 - 25.0	
Health worries				0.312			0.835
Mean (SD)	14.4 (4.7)	12.9 (3.2)	13.6 (4.0)		12.7 (4.9)	13.1 (5.2)	12.9 (5.0)	
Range	7.0 - 25.0	9.0 - 19.0	7.0 - 25.0		5.0 - 21.0	5.0 - 24.0	5.0 - 24.0	
Financial worries				0.833			0.543

Mean (SD)	9.6 (3.5)	9.4 (3.6)	9.5 (3.5)		11.1 (3.3)	10.2 (4.6)	10.7 (4.0)	
Range	4.0 - 16.0	4.0 - 15.0	4.0 - 16.0		6.0 - 18.0	4.0 - 19.0	4.0 - 19.0	
HIV mastery				0.686				0.369
Mean (SD)	10.3 (3.1)	9.9 (2.4)	10.1 (2.7)		9.8 (2.9)	10.9 (3.6)	10.3 (3.3)	
Range	5.0 - 15.0	6.0 - 14.0	5.0 - 15.0		4.0 - 15.0	5.0 - 15.0	4.0 - 15.0	
Life satisfaction				0.762				0.216
Mean (SD)	29.0 (6.4)	28.3 (5.9)	28.6 (6.1)		25.9 (5.8)	28.6 (6.2)	27.3 (6.1)	
Range	20.0 - 40.0	19.0 - 40.0	19.0 - 40.0		17.0 - 37.0	19.0 - 39.0	17.0 - 39.0	
Medication concerns				0.791				1.000
Mean (SD)	13.4 (3.1)	13.1 (2.6)	13.3 (2.8)		13.3 (2.8)	13.3 (3.0)	13.3 (2.9)	
Range	5.0 - 17.0	9.0 - 18.0	5.0 - 18.0		10.0 - 19.0	9.0 - 20.0	9.0 - 20.0	
Provider trust				0.631				0.880
Mean (SD)	10.4 (3.2)	9.9 (3.1)	10.1 (3.1)		10.8 (3.8)	10.9 (3.1)	10.8 (3.4)	
Range	5.0 - 15.0	5.0 - 15.0	5.0 - 15.0		3.0 - 15.0	4.0 - 15.0	3.0 - 15.0	

1. Linear Model ANOVA

Table 11. LMM results on quality of life

	Quality of Life		
Predictors	*β*	*CI*	*p*
(Intercept)	134.3	122.39 – 146.22	**<0.001**
timepoint	-1.09	-3.21 – 1.03	0.308
tx	-5.52	-21.84 – 10.79	0.5
timepoint:tx	1.93	-0.97 – 4.84	0.188
Random Effects			
σ^2	125.52		
$\tau 00_{pid}$	290.59		
ICC	0.7		
N_{pid}	30		
Observations	60		
Marginal R^2 / Conditional R^2	0.009 / 0.701		

Table 12. Medication adherence

	Control group				Intervention group			
	Baseline (N=13)	Endline (N=13)	Total (N=8)	p^2	Baseline (N=14)	Endline (N=14)	Total (N=14)	p^2
Adherence total score				0.431				0.208
Mean (SD)	99.3 (0.8)	98.8 (1.7)	99.0 (1.3)		99.3 (0.7)	99.6 (0.5)	99.5 (0.7)	
Range	98.0 - 100.0	93.4 - 100.0	93.4 - 100.0		98.0 - 100.0	98.7 - 100.0	98.0 - 100.0	
Number of days missed medication				0.783				0.071
Mean (SD)	98.7 (2.5)	99.0 (2.1)	98.9 (2.3)		100.0 (0.0)	99.3 (1.4)	99.6 (1.0)	
Range	93.4 - 100.0	93.4 - 100.0	93.4 - 100.0		100.0 - 100.0	96.7 - 100.0	96.7 - 100.0	
How well followed instructions				0.742				0.158
Mean (SD)	75.6 (21.6)	72.6 (25.0)	74.1 (22.9)		80.2 (19.0)	90.1 (16.9)	85.2 (18.4)	
Range	40.6 - 100.0	20.8 - 100.0	20.8 - 100.0		40.6 - 100.0	40.6 - 100.0	40.6 - 100.0	
How often followed instructions				0.659				0.335
Mean (SD)	86.3 (12.5)	83.2 (21.2)	84.8 (17.1)		88.7 (12.8)	92.9 (9.8)	90.8 (11.4)	
Range	60.4 - 100.0	20.8 - 100.0	20.8 - 100.0		60.4 - 100.0	80.2 - 100.0	60.4 - 100.0	

1. Time frame of all three adherence questions were in the past 30 days. All data was linearly transformed so that the final score fell between 1-100.

2. Linear Model ANOVA

Table 13. LMM results on adherence

	Adherence (Total)			**Adherence days**			**Adherence well**			**Adherence often**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	99.36	98.67 – 100.05	<0.001	98.67	97.54 – 99.79	<0.001	76.39	63.04 – 89.75	<0.001	87.05	77.54 – 96.57	<0.001
timepoint	-0.11	-0.27 – 0.06	0.204	0.06	-0.18 – 0.31	0.61	-0.76	-3.74 – 2.22	0.61	-0.76	-2.97 – 1.45	0.492
tx	-0.12	-1.07 – 0.84	0.809	1.51	-0.06 – 3.07	0.058	1.33	-17.21 – 19.88	0.886	0.57	-12.64 – 13.79	0.931
timepoint:tx	0.18	-0.04 – 0.41	0.111	-0.24	-0.59 – 0.10	0.168	3.24	-0.91 – 7.38	0.123	1.82	-1.25 – 4.89	0.239
Random Effects												
σ2	0.7			1.59			228.89			125.84		
τ00 pid	0.39			1.51			201.45			86.68		
ICC	0.36			0.49			0.47			0.41		
N pid	27			27			27			27		
Observations	54			54			54			54		
Marginal R2 / Conditional R2	0.072 / 0.403			0.070 / 0.523			0.095 / 0.519			0.057 / 0.441		

Table 14. Difficulties in emotion regulation

	Control							Intervention						
	Base-line (n = 14)	Week 1 (n = 14)	Week 2 (n = 14)	Week 3 (n = 14)	Week 4 (n = 14)	Total	*p*[1]	Base-line (n = 16)	Week 1 (n = 16)	Week 2 (n = 16)	Week 3 (n = 16)	Week 4 (n = 16)	Total	*p*[1]
Total							0.883							0.538
Mean (SD)	39.8 (9.7)	41.7 (12.1)	38.4 (6.7)	40.6 (9.7)	41.6 (9.7)	40.4 (9.5)		43.6 (10.4)	38.4 (12.0)	39.9 (11.8)	37.5 (10.0)	37.8 (11.8)	39.5 (11.2)	
Range	27.0 - 66.0	26.0 - 72.0	28.0 - 50.0	24.0 - 64.0	23.0 - 63.0	23.0 - 72.0		30.0 - 65.0	24.0 - 59.0	27.0 - 71.0	29.0 - 60.0	22.0 - 71.0	22.0 - 71.0	
Lack of strategies							0.950							0.839
Mean (SD)	6.6 (2.8)	6.9 (3.2)	6.2 (2.4)	6.8 (3.1)	7.0 (2.7)	6.7 (2.8)		6.7 (2.4)	6.1 (2.7)	6.2 (3.2)	5.6 (2.1)	5.9 (2.7)	6.1 (2.6)	
Range	3.0 - 14.0	3.0 - 15.0	3.0 - 13.0	3.0 - 15.0	4.0 - 14.0	3.0 - 15.0		3.0 - 11.0	3.0 - 12.0	3.0 - 15.0	3.0 - 11.0	3.0 - 14.0	3.0 - 15.0	
Non-acceptance							0.971							0.499
Mean (SD)	6.4 (2.8)	6.8 (2.8)	6.6 (2.2)	6.9 (2.6)	7.1 (2.6)	6.7 (2.5)		7.5 (3.6)	6.4 (2.6)	6.4 (3.3)	5.5 (2.5)	6.2 (3.0)	6.4 (3.0)	
Range	3.0 - 15.0	3.0 - 15.0	4.0 - 11.0	3.0 - 12.0	3.0 - 12.0	3.0 - 15.0		3.0 - 15.0	3.0 - 12.0	3.0 - 15.0	3.0 - 12.0	3.0 - 15.0	3.0 - 15.0	

Impulse							0.634						0.956
Mean (SD)	5.3 (1.6)	5.2 (1.7)	4.8 (1.4)	4.9 (2.0)	5.8 (2.2)	5.2 (1.8)		5.8 (3.3)	5.3 (2.5)	5.3 (3.3)	5.0 (2.4)	5.2 (2.6)	5.3 (2.8)	
Range	3.0 - 9.0	3.0 - 9.0	3.0 - 7.0	3.0 - 10.0	3.0 - 12.0	3.0 - 12.0		3.0 - 12.0	3.0 - 10.0	3.0 - 15.0	3.0 - 10.0	3.0 - 12.0	3.0 - 15.0	
Interrupt goals							0.837						0.516
Mean (SD)	6.4 (1.2)	6.8 (2.9)	6.1 (1.9)	7.0 (2.4)	6.9 (2.5)	6.6 (2.2)		7.0 (3.0)	5.9 (2.2)	5.9 (2.3)	5.6 (2.1)	5.9 (2.1)	6.1 (2.4)	
Range	4.0 - 9.0	3.0 - 15.0	3.0 - 10.0	3.0 - 14.0	3.0 - 12.0	3.0 - 15.0		3.0 - 12.0	3.0 - 10.0	3.0 - 10.0	3.0 - 9.0	3.0 - 12.0	3.0 - 12.0	
Lack of awareness							0.958						0.648
Mean (SD)	9.4 (2.8)	9.8 (2.9)	9.1 (2.6)	9.0 (3.4)	9.1 (3.3)	9.3 (2.9)		9.9 (3.0)	8.8 (2.5)	9.4 (2.7)	9.7 (3.1)	8.6 (2.8)	9.3 (2.8)	
Range	6.0 - 14.0	3.0 - 13.0	4.0 - 13.0	3.0 - 14.0	3.0 - 13.0	3.0 - 14.0		3.0 - 13.0	4.0 - 12.0	6.0 - 14.0	4.0 - 15.0	4.0 - 13.0	3.0 - 15.0	
Lack of clarity							0.966						0.784
Mean (SD)	5.7 (2.7)	6.2 (3.4)	5.6 (2.0)	6.1 (2.5)	5.8 (2.4)	5.9 (2.6)		6.7 (2.5)	5.9 (2.4)	6.6 (2.9)	6.1 (2.4)	5.8 (2.3)	6.2 (2.5)	
Range	3.0 - 12.0	3.0 - 15.0	3.0 - 9.0	3.0 - 13.0	3.0 - 13.0	3.0 - 15.0		3.0 - 12.0	3.0 - 10.0	3.0 - 15.0	3.0 - 12.0	3.0 - 12.0	3.0 - 15.0	

1. Linear model ANOVA

Table 15. LMM results on difficulties in emotion regulation

	DERS			Non-acceptance of emotions			Emotion interference on goals		
Predictors	*β*	*CI*	*p*	*β*	*CI*	*p*	*β*	*CI*	*p*
(Intercept)	39.64	33.99 – 45.28	<0.001	6.34	4.81 – 7.86	<0.001	6.26	5.01 – 7.52	<0.001
timepoint	0.26	-0.58 – 1.11	0.536	0.14	-0.15 – 0.42	0.35	0.12	-0.13 – 0.37	0.338
tx	3.61	-4.12 – 11.35	0.357	1.09	-1.00 – 3.17	0.304	0.54	-1.17 – 2.25	0.535
timepoint:tx	-1.56	-2.72 – -0.41	**0.008**	-0.48	-0.88 – -0.09	**0.016**	-0.37	-0.72 – -0.03	**0.032**
Random Effects									
σ^2	25.37			2.93			2.23		
$\tau 00_{pid}$	86.41			5.07			3.16		
ICC	0.77			0.63			0.59		
N_{pid}	30			30			30		
Observations	148			148			148		
Marginal R^2 / Conditional R^2	0.019 / 0.777			0.022 / 0.642			0.030 / 0.598		

1. DERS: Difficulties in emotion regulation. Two subscale results are presented here.

Table 15. Coping self-efficacy

	Control							Intervention						
	Base-line (n = 14)	Week 1 (n = 14)	Week 2 (n = 14)	Week 3 (n = 14)	Week 4 (n = 14)	Total	p^1	Base-line (n = 16)	Week 1 (n = 16)	Week 2 (n = 16)	Week 3 (n = 16)	Week 4 (n = 16)	Total	p^1
Total							0.831							0.937
Mean (SD)	92.3 (21.3)	97.4 (18.4)	98.6 (16.8)	92.6 (19.7)	92.8 (16.1)	94.7 (18.2)		92.1 (23.7)	97.7 (23.3)	96.9 (24.3)	100.2 (26.7)	97.3 (30.8)	96.7 (25.3)	
Range	67.0 - 128.0	65.0 - 127.0	70.0 - 125.0	58.0 - 132.0	67.0 - 117.0	58.0 - 132.0		57.0 - 124.0	56.0 - 143.0	55.0 - 143.0	56.0 - 143.0	32.0 - 143.0	32.0 - 143.0	
Use problem-focused coping							0.920							0.993
Mean (SD)	45.9 (9.3)	47.8 (8.6)	48.9 (9.9)	46.8 (11.2)	45.9 (10.5)	47.0 (9.7)		49.1 (10.6)	49.6 (10.0)	48.2 (10.0)	48.9 (11.8)	47.9 (13.7)	48.8 (11.0)	
Range	32.0 - 63.0	30.0 - 64.0	35.0 - 66.0	25.0 - 66.0	30.0 - 62.0	25.0 - 66.0		28.0 - 66.0	31.0 - 66.0	26.0 - 66.0	23.0 - 66.0	19.0 - 66.0	19.0 - 66.0	
Stop unpleasant emotions and thoughts							0.725							0.763
Mean (SD)	28.4 (8.2)	29.5 (6.6)	30.3 (6.7)	26.6 (8.7)	28.4 (6.0)	28.6 (7.2)		27.2 (10.7)	28.7 (8.5)	29.9 (9.5)	32.0 (9.2)	29.4 (11.1)	29.4 (9.8)	

Range	16.0 - 44.0	16.0 - 38.0	15.0 - 40.0	12.0 - 44.0	19.0 - 39.0	12.0 - 44.0		9.0 - 43.0	7.0 - 44.0	12.0 - 44.0	18.0 - 44.0	6.0 - 44.0	6.0 - 44.0	
Get support from friends and family							0.906							0.663
Mean (SD)	18.1 (6.5)	20.1 (5.6)	19.4 (5.3)	19.2 (6.3)	18.5 (5.3)	19.1 (5.7)		15.7 (9.5)	19.4 (8.7)	18.7 (8.3)	19.3 (8.3)	20.1 (9.0)	18.6 (8.7)	
Range	7.0 - 30.0	12.0 - 29.0	12.0 - 30.0	9.0 - 33.0	5.0 - 27.0	5.0 - 33.0		3.0 - 31.0	3.0 - 33.0	3.0 - 33.0	6.0 - 33.0	3.0 - 33.0	3.0 - 33.0	

1. Linear Model ANOVA

Table 16. HIV stigma

	Control							**Intervention**						
	Base-line (n = 14)	Week 1 (n = 14)	Week 2 (n = 14)	Week 3 (n = 14)	Week 4 (n = 14)	Total	*p*[1]	Base-line (n = 16)	Week 1 (n = 16)	Week 2 (n = 16)	Week 3 (n = 16)	Week 4 (n = 16)	Total	*p*[1]
Total							0.957							0.971
Mean (SD)	36.6 (5.4)	35.3 (5.4)	35.8 (5.7)	35.7 (5.5)	35.1 (5.5)	35.7 (5.3)		36.6 (5.7)	35.9 (7.6)	35.6 (6.9)	34.9 (7.4)	36.5 (8.6)	35.9 (7.2)	
Range	29.0 - 45.0	24.0 - 42.0	24.0 - 43.0	20.0 - 43.0	23.0 - 44.0	20.0 - 45.0		20.0 - 46.0	18.0 - 47.0	21.0 - 47.0	23.0 - 48.0	19.0 - 48.0	18.0 - 48.0	

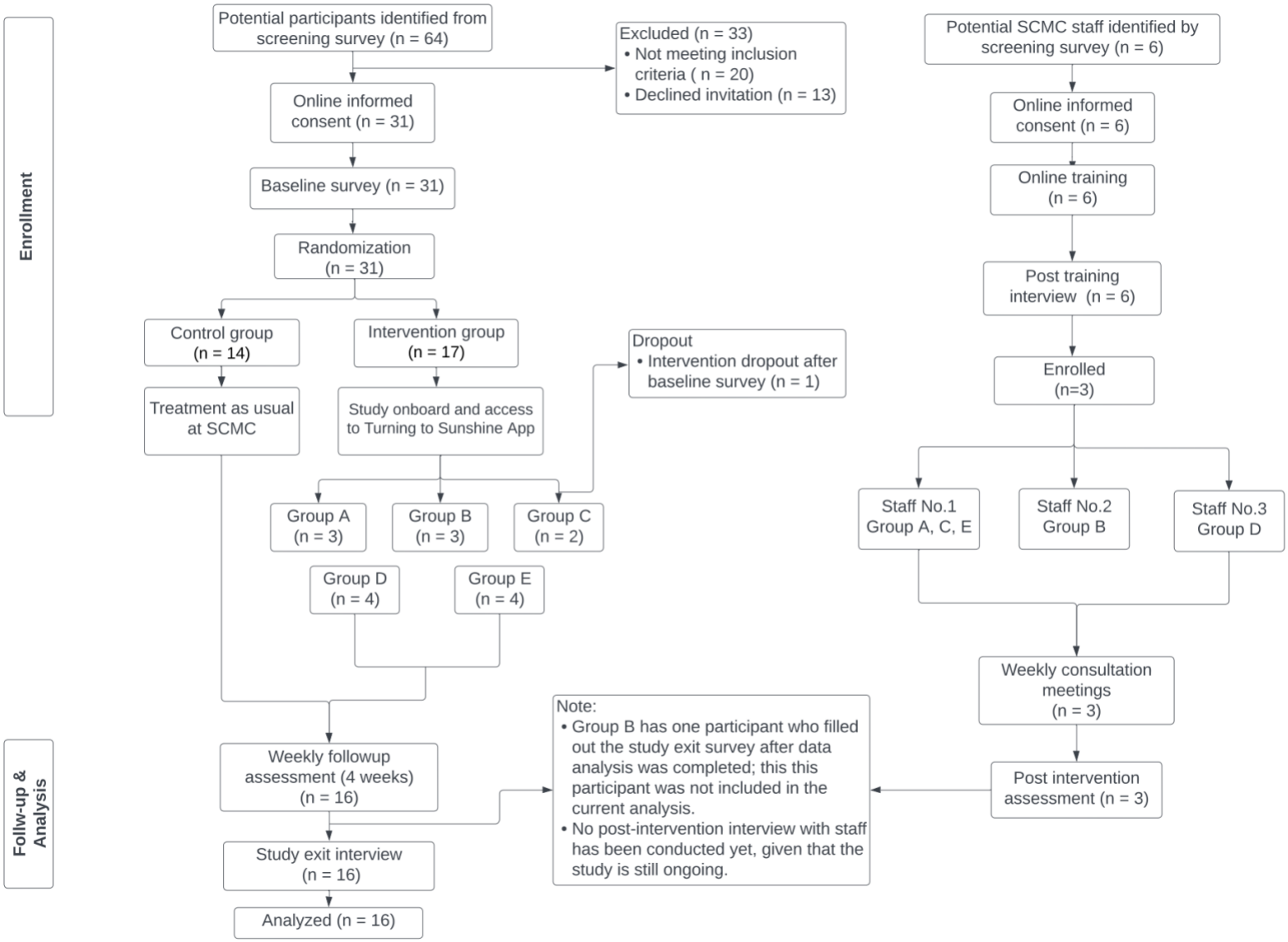
Personalized stigma							0.894						0.933
Mean (SD)	8.1 (2.7)	7.6 (2.4)	8.5 (2.3)	8.3 (2.0)	8.1 (1.8)	8.1 (2.2)		8.8 (2.0)	8.7 (2.5)	8.6 (2.3)	8.2 (2.7)	9.0 (2.6)	8.7 (2.4)	
Range	3.0 - 12.0	3.0 - 11.0	4.0 - 12.0	4.0 - 12.0	6.0 - 12.0	3.0 - 12.0		4.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	
Disclosure concerns							0.973						0.842
Mean (SD)	10.7 (1.7)	10.4 (1.9)	10.3 (1.9)	10.6 (1.9)	10.6 (1.9)	10.5 (1.8)		9.7 (2.2)	9.6 (1.9)	9.8 (1.8)	9.9 (1.7)	10.3 (2.0)	9.8 (1.9)	
Range	7.0 - 12.0	5.0 - 12.0	6.0 - 12.0	6.0 - 12.0	6.0 - 12.0	5.0 - 12.0		5.0 - 12.0	5.0 - 12.0	7.0 - 12.0	7.0 - 12.0	6.0 - 12.0	5.0 - 12.0	
Concerns about public attitudes							0.422						0.746
Mean (SD)	10.6 (1.6)	10.5 (1.2)	10.0 (1.8)	9.9 (1.8)	9.5 (2.2)	10.1 (1.7)		10.8 (1.4)	10.2 (1.7)	10.4 (1.9)	10.1 (1.9)	10.0 (2.2)	10.3 (1.8)	
Range	7.0 - 12.0	8.0 - 12.0	6.0 - 12.0	5.0 - 12.0	3.0 - 12.0	3.0 - 12.0		8.0 - 12.0	7.0 - 12.0	7.0 - 12.0	7.0 - 12.0	5.0 - 12.0	5.0 - 12.0	
Negative self-image							0.993						0.961
Mean (SD)	7.2 (2.6)	6.8 (2.4)	7.0 (2.4)	6.9 (2.2)	7.0 (2.3)	7.0 (2.3)		7.3 (2.4)	7.4 (2.9)	6.8 (3.1)	6.8 (3.2)	7.2 (3.2)	7.1 (2.9)	
Range	3.0 - 11.0	3.0 - 10.0	3.0 - 10.0	3.0 - 11.0	3.0 - 10.0	3.0 - 11.0		3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	3.0 - 12.0	

1. Linear Model ANOVA

Table 17. LLM results on CSE and HIV stigma

	CSE				HIV Stigma		
Predictors	*β*	*β*	*CI*	*p*	*β*	*CI*	*p*
(Intercept)	95.85	83.61 – 108.09	<0.001	36.49	33.02 – 39.95	<0.001	36.49
timepoint	-0.38	-1.95 – 1.20	0.635	-0.26	-0.72 – 0.21	0.273	-0.26
tx	-2.76	-19.52 – 13.99	0.745	-0.28	-5.02 – 4.46	0.907	-0.28
timepoint:tx	1.52	-0.65 – 3.68	0.168	0.18	-0.46 – 0.81	0.583	0.18
Random Effects							
σ^2	88.82			7.65			
$\tau 00_{pid}$	438.81			34.56			
ICC	0.83			0.82			
N_{pid}	30			30			
Observations	148			148			
Marginal R^2 / Conditional R^2	0.004 / 0.832			0.002 / 0.819			

Figure 1. Trial CONSORT diagram


Enrollment
Follw-up & Analysis
Potential participants identified from screening survey (n = 64)
Excluded (n = 33)
• Not meeting inclusion criteria (n = 20)
• Declined invitation (n = 13)
Online informed consent (n = 31)
Baseline survey (n = 31)
Randomization (n = 31)
Control group (n = 14)
Intervention group (n = 17)
Dropout
• Intervention dropout after baseline survey (n = 1)
Treatment as usual at SCMC
Study onboard and access to Turning to Sunshine App
Group A (n = 3)
Group B (n = 3)
Group C (n = 2)
Group D (n = 4)
Group E (n = 4)
Weekly followup assessment (4 weeks) (n = 16)
Study exit interview (n = 16)
Analyzed (n = 16)
Note:
• Group B has one participant who filled out the study exit survey after data analysis was completed; this this participant was not included in the current analysis.
• No post-intervention interview with staff has been conducted yet, given that the study is still ongoing.
Potential SCMC staff identified by screening survey (n = 6)
Online informed consent (n = 6)
Online training (n = 6)
Post training interview (n = 6)
Enrolled (n=3)
Staff No.1 Group A, C, E
Staff No.2 Group B
Staff No.3 Group D
Weekly consultation meetings (n = 3)
Post intervention assessment (n = 3)

Appendix 1. SCMC staff training material

Session #	Training topic
Session 1	Emotions and emotion regulation skills
Session 2	Validation and active listening
Session 3	Problem solving, hope generation, and crisis intervention
Session 4	Study and app overview, online skills group logistics

Note: All training materials were based on DBT Skills training manual (Linehan, 2014), created in Chinese, and translated to English for committee to review.

Session 1 syllabus: Emotions and emotion regulation skills

Prepare:

- Send course content to staff
- Take off the staff hat and put on the healer hat

10:30-10:40 Self-introduction (meditation practice)

10:40-11:10 Understanding Emotions, **Ladder of emotion intensity

11:10-11:20 Break

11:20-11:50 Distress tolerance and reality acceptance

11:50-12:25 Emotion regulation

12:25-12:30 **After class exercises:

- Record the following exercises, in units of skills, each of which is recorded
    - Event background, practice process, practice results, reflection
- When facing an emotional event, or feeling an emotion, try to practice the techniques described
    - Do not need to experience extreme pain to practice the relevant skills;
- Reflect on or observe the skills that clients may need in their daily work, and how to help them practice

10:40-11:10 Understanding Emotions, ** Ladder of emotion intensity

Misconceptions about emotions

Please write how to challenge these misconceptions and accept emotions

1. Every situation has a right way to feel.
2. Telling someone I am in a bad mood is a sign of weakness.
3. Negative emotions are bad and destructive.
4. ***Feeling emotions means letting them out of control.**
5. Some emotions are silly.
6. All painful emotions are the result of a bad attitude.
7. If others think my emotions are irrational, my emotions are obviously wrong.
8. Other people should decide my moods and feelings, not me.
9. Painful emotions are unimportant and should be ignored.
10. Extreme emotions can get you there more effectively than trying to regulate them.
11. Creativity requires intense, often out-of-control emotions.
12. The dramatic mood is cool.
13. Trying to change how you feel or express yourself is not being true to yourself or others.
14. ***Emotional truth more important than the truth of the *facts.**
15. **People should do whatever they want, depending on their mood. eg, don't go to the gym if you don't want to, don't take medicine if you don't want to.**
16. My emotions are part of my personality.
17. My emotions are why people like me.
18. Emotions arise for no reason.

Emotional function

1. Emotions drive (and organize) us into action

Examples: Anxiety about health - take medication and see a doctor on time; Fear - run/hide; Shame - hide;

- Emotions drive behavior. Prepare for our action. The urge to act associated with some emotions is born with it.
- In important situations, emotions save us the time to act. Emotions are especially important when we don't have time to think carefully.
- Strong emotions help us overcome psychological and environmental barriers.

2. Emotions send messages to (and influence) others

- Facial expressions are a natural outgrowth of emotions. Facial expressions convey information faster than words.
- Our body language and tone of voice are also natural outgrowths of our emotions. They also communicate our emotions to others.
- *When the purpose of an emotion is to communicate or convey a very important message to another person, it can be very difficult to change the emotion.
- Whether consciously or not, our emotional expressions can affect others.

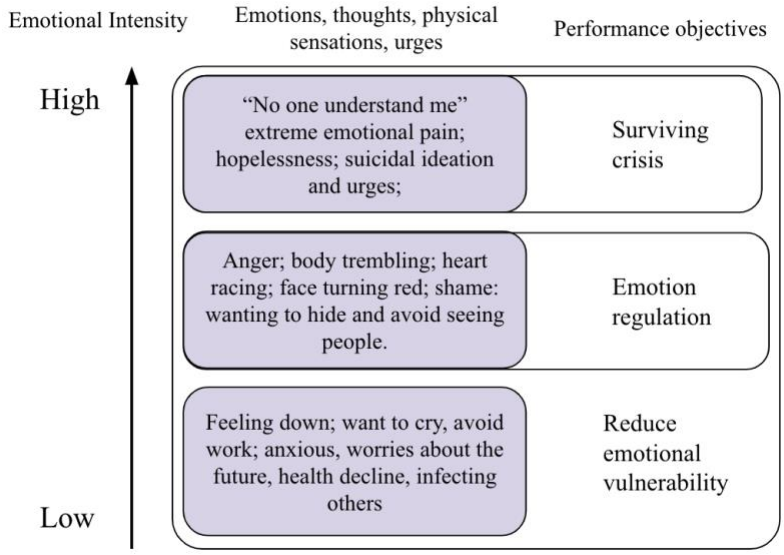
3. Emotions send messages to ourselves

- Emotional responses can give us important information about a situation. Emotions can be a signal or alarm that something is happening. Intuition, sometimes very accurate. eg When walking in a dark alley, I unconsciously quicken my pace
- <u>Warning: Sometimes we treat emotions as facts in the world: the stronger the emotion, the more we think it is based on fact. For example:</u>
    - "If I'm not sure about something, I'm powerless"
    - "If I'm confident in something, it's right"
    - "If I'm afraid, there must be danger"
    - "I love him, so he must be good"
- Sometimes emotions can blind us to the truth, and instead we automatically look for evidence to support it. For example,
    - Strong sadness and loneliness sometimes make us ignore, in fact, there are always one or two people around us who really care about us.

Emotional ladder

Showcase with BoardMix

1. Application in HIV post testing
2. Emotional intensity, a scale of 1-10
3. Related thoughts and urges, with examples
4. Related skill
5. All skills, especially skills for surviving a crisis, are practiced at all ladder levels!



11:20-11:50 Distress tolerance and reality acceptance

When to use skills related to surviving a crisis?

1. emotional crisis
    a. very stressful
    b. Short-term (that is, it doesn't last long).
    c. Creates intense pressure to do something right away to make the crisis go away.
2. Consider using pain-bearing techniques when
    a. You have intense emotional pain but cannot get help quickly, or the emotional event cannot be resolved immediately.
    b. You want to act on your emotions, but that only makes things worse.
    c. Emotional psychology governs your behavior, but you want to regulate your emotions and act rationally.
    d. Emotions are strong, but current affairs must be done. eg Receive bad news during a work meeting, but insist on finishing the meeting.
3. Do not use pain-bearing techniques when
    a. Everyday problems we encounter every day: such problems may require us to sit down and think about how to solve the problem
    b. solve all problems in life
    c. make your life worth living

STOP! Make a list of pros and cons

This content is not in the blog, and due to various considerations, we think that this content is best taught by the staff as an activity in the group to the members.

1. STOP said to myself: Stop!
    a. stop:
        i. stop! freeze! Don't make any moves! Your emotions may lead you to act impulsively and without thinking. Take control of your behavior!
    b. take a step back
        i. Take a step back and exit from the current situation. take a break. let go. take a deep breath. Don't let your feelings make you act impulsively.

c. observe

    i. Be aware of what's going on inside and outside of you. What is the situation? What are your thoughts and feelings? What is the other person saying or doing? It is a process of gathering information and distracting oneself.

d. act with caution

    i. Consider your goals. Ask your heart: Which actions will make the situation better or worse?

2. list of pros and cons

    a. Doing so will allow you to practice rational and calm thinking when you stop, and recognize the consequences of acting impulsively

	excellent	lack
act impulsively		
don't act impulsively		

Cooling down through physical and emotional

1. Cool your face with cold water (to cool down quickly)

    a. Hold your breath, put your face in a bowl of cold water,

    b. Or put cold patches (or ziplock bags filled with cold water) on your eyes and cheeks.

    c. Hold for 30 seconds. Keep the water temperature above 10°C.

    d. ice packs or ice water

2. Vigorous exercise (to cool the body when emotions are arousing it)

    a. Get vigorous exercise, even if it's only short. Such as HIIT

    b. Consume the energy stored in the body by running, brisk walking, jumping, playing basketball, lifting weights, etc.

3. Rhythmic breathing (regulating breathing by slowing down the breathing rate)

    a. Breathe deeply into your belly.

    b. Slowly slow down your breathing rate (usually five to six breaths per minute).

c. Exhale at a slower rate than inhale (for example, inhale for 5 seconds and exhale for 7 seconds).

4. Paired Muscle Relaxation (Calm down by paired muscle relaxation and exhalation)

Ling Xiao recorded a meditation exercise for muscle relaxation training. If you are interested, you are encouraged to try it

a. Tension the body muscles (not so much that they cause cramping) as you take a deep breath into the abdomen.

b. Notice the tension in your body.

c. As you exhale, mentally say the word "relax."

d. Allow the tension in the muscles to slowly leave the body.

e. Notice the changes in your body.

Soothe the Emotions through the Senses

Use our five senses, namely sight, hearing, smell, taste and touch, to soothe the body and the emotions

1. vision

a. Watch the stars at night.

b. See pictures you like.

c. Buy a beautiful flower.

d. Make the space of a room look good.

e. Light a candle and watch the flames.

f. Make a beautiful place on the table with the best things.

g. Go see people or window shop.

h. Go to a museum or poster shop that has beautiful artwork.

2. hearing

a. Listen to soothing or uplifting music.

b. Pay attention to the sounds of nature (waves, birds, rain, rustling leaves).

c. Pay attention to the sounds of the city (traffic, horns, urban music).

d. Sing your favorite song.

e. Hum a soothing tune.

f. Learn to play an instrument.

g. Turn on the radio.

3. the sense of smell

    a. Use your favorite soap, shampoo, aftershave, perfume, skin cream, or try it at the store.

    b. Burn incense or light scented candles.

    c. Open a packet of coffee and smell its aroma.

    d. Apply lemon oil to furniture.

    e. Place floral or eucalyptus oil in the room.

    f. Eat your favorite foods.

    g. Drink your favorite soothing beverage such as herbal tea, hot chocolate, latte or smoothie.

    h. Sitting in a new car and breathing in the aroma.

    i. Smell the roses.

    j. Take a walk in the woods and carefully breathe in the fresh scents of nature.

    k. Open the windows and smell the air.

4. taste

    a. Contains a mint.

    b. Chew your favorite gum.

    c. Try some special food that you don't eat often, like freshly squeezed orange juice or your favorite candy.

    d. Pay attention to the taste of the food you eat. Just eat when you eat.

5. sense of touch

    a. "Pick the cat".

    b. Massage, soak your feet.

    c. Apply a moisturizing skin cream.

    d. Apply a cold compress to the forehead.

e. Sit quietly in a comfortable chair.

f. Wrap yourself in a soft, warm blanket. Give yourself a hug.

Fully accept

1. What is radical acceptance?

    a. Whether we like reality or not, whether it is beneficial or unfavorable to us, we fully accept it in the present moment, even if it is painful, we can clearly see the pain.

    b. Totally, means "all around": your thoughts, emotions, and body (body, heart, spirit)

        i. When faced with reality, there can be a big emotional reaction, a lot of frustrated or angry thoughts, and letting yourself feel those reactions is part of acceptance.

    c. When you refuse to accept or face reality, you will think that fate is unfair, complain in your heart, and lose your temper with reality. Total acceptance is the exact opposite of that.

2. Accept what

    a. Reality is what it is (truths about the past and present are facts, even if you don't like or want to admit it).

    b. Everyone's future has limits (but don't exaggerate that limit just because you have an emotional eye).

    c. Everything happens for a reason (including events and circumstances that cause you pain and suffering).

    d. Even when painful events occur, life can be worthwhile.

3. Why radical acceptance

    a. Denying reality cannot change reality.

    b. Changing reality starts with accepting reality.

    c. Pain can't be avoided, it's a very valuable signal, and it usually means that something is wrong in your life.

    d. Denial of reality can turn pain into long-term torment.

    e. Refusing to accept reality can leave you in unhappiness, resentment, anger, sadness, shame, or other painful emotions.

f. Acceptance can lead to sadness, but it can lead to deep peace.

The key to total acceptance

1. Fully accept *not* the following
    a. agree, passivity, or no change
2. Remind yourself that your present reality, no matter how difficult, is only temporary. Life won't be like this forever.
    a. The law of the world is that change is the only constant.
3. "It's okay to lie flat once in a while", take a break before continuing
    a. Allowing yourself to escape from reality for short periods of time, all the while facing a reality that is emotionally stressful to you for a long time, can leave you feeling exhausted.
4. Total acceptance is a process of constantly facing difficult situations and realities, and actively choosing to accept.
    a. The more difficult the reality, the more twists and turns. It may take a long time, many times and frequently to choose to accept.
    b. Imagine being at a fork in the road, constantly choosing the path that leads to acceptance.
5. Use the pros and cons list to recognize the benefits of accepting reality as it is.

Using the Body to Practice Whole Acceptance: Smiling and Open Hands (LX)

Remember, your brain sends signals to your body; conversely, your body's actions and activities also send signals to your brain.

1. Smiling

Visualize your own facial expression when you are angry or rejecting something, and then do it the other way around

1) Relax your face from head to chin.
    a) Relax each facial muscle (forehead, eyes and brows; cheeks, mouth and tongue; teeth slightly apart). If you have difficulty, try tensing your facial muscles, then relaxing them.
    b) A nervous grin is a toothy grin (which may tell your brain that you're hiding or masking your true feelings).

2) Let the corners of your mouth turn up slightly, just feel them. No one else needs to see it.
    a) A half smile is one with slightly upturned lips and a relaxed face.
3) Try adopting a calm facial expression.
    a) Remember, your face communicates to your brain; your body communicates to your heart.

2. Open hands

imagine yourself receiving a gift

1) stand up
    a) Keep your arms down from your shoulders; stay upright or bend your elbows slightly. Relax palms, backs of hands outward, thumbs out to sides, palms up, fingers relaxed.
2) sitting position
    a) Place your hands on your thighs or knees. Relax your palms, with the backs of your hands facing out, palms facing up, and fingers relaxed.
3) lie flat
    a) Arms by side, palms relaxed, fingers relaxed, palms up.

11:50-12:25 Emotional management

Work against emotions to change emotions

Acting on emotions can sometimes backfire. Realizing this, we can change our emotional responses by actively working against our emotions. Examples of invitations.

1. Every emotion has its own behavioral impulse, such as

mood	**Impulsive behavior**	**opposite behavior**
fear	escape/dodge	go ahead, face your fears
anger	attack	dodge, be friendly
sad	withdrawal/self-isolation	move!
ashamed	hide/escape	Tell your shameful secrets to someone you trust, someone you think will accept you.

2. Key steps to working with your emotions
    a. Recognize the emotions you want to change or manage
        i. sad
    b. Recognize emotions and the behaviors that result from emotional impulses
        i. Sadness triggers social withdrawal, lying at home, and avoiding contact with the outside world
    c. Reflect on whether the euphoria caused by emotions hinders the achievement of goals
        i. If you lie at home for a day, how will your mood change? Might be even lower.
    d. Behavior contrary to emotional impulses
        i. Go for a run in the park, hang out with friends
    e. Repeat the behavior until the mood changes

i. Do it once, it may have a limited effect on your mood, and repeat until you feel the difference.

Increase emotional resilience

Sometimes an hour may cause an emotional collapse. Everyone can use some practical skills in life to cultivate their emotional resilience, reduce their sensitivity to negative emotions, and speed up their recovery process.

1. Accumulate positive emotions, consolidate emotional "dams", and prevent emotional bursts
    a. Short term: Do things that generate positive emotions
2. Clarify values and act in accordance with values
    a. Long-term: thinking about values, who, what, and what activities are important to our lives, and what we want our lives to be like. Create a life worth living.
    b. When our actions are aligned with our values, it becomes the source of long-lasting positive emotions.
3. Persist in moving towards the goal every day and accumulate a sense of accomplishment
    a. A sense of accomplishment is important to our emotional health. Set short-term and long-term goals for yourself, and every small step towards your goals is worth celebrating.
4. Take care of your body and improve your mood
    a. Seek immediate medical attention if you feel unwell
    b. A balanced diet
    c. sleep health
    d. regular exercise
    e. Avoid using alcohol, smoking, or other drugs to regulate mood; short-term help to escape, long-term negative effects cannot be ignored.

Session 2 syllabus: Validation and active listening

Prepare:

- Send course content to staff
- Take off the staff hat and put on the counselor hat

10:30-10:35 Meditation practice

10:35-10:40 Remaining issues

10:40-11:30 Empathy skills

11:30-12:25 Empathy Practice

12:25-12:30 **After class exercises:

- Record the following exercises, in units of empathy skills, for each level of empathy
    - Event background, practice process, practice results, reflection
- Reflect on or observe the skills that clients may need in their daily work, and how to help them practice

Sexual harassment

- Look at the essence through the phenomenon
    - Maybe lonely, maybe just trying to get distracted
    - May want to set up a person-to-person practice
- this behavior cannot be encouraged
- Ignore; natural extinguish the behavior
    - do not respond
- From the beginning of the communication, establish expectations and boundaries
- Consider having rules or regulations around this to guide client's behavior

After consulting with Vibh

- Two-step empathy (simplified to increase mastery)
    - 1) Ask about the emotions you feel at the time of the visit
        - Note that it's emotions, not ideas; if the visitor says: I don't know what to do, my work will be affected, my family's reaction will be great, etc.
            - These are thoughts, and notice the emotional feelings behind them: confusion, fear, anxiety, worry

- 2) Acknowledge the client's emotions in some way - look for reasons that support those emotions
    - Incorporate your understanding of the life and challenges faced by the HIV-infected person, and acknowledge his emotions. Sentence pattern:
        - Because of XXXX, you have these emotions and your thoughts are understandable.
        - Many people have similar experiences/emotional reactions
    - Combined with your understanding of this visitor, recognize his emotions,
        - I remember you said that the relationship between you and your family members is not very good, and you are worried that they will make your relationship more tense if they find out. Your worry is understandable.

Review homework

- Identify skills
- Encouragement
- Summarize and help reinforce skill use and behaviors

10:30-10:40 Remaining issues from last two sessions

Feedback and Thoughts on the Emotional Ladder

Emotional management methods are effective when emotions are moderate to low in intensity. When emotions are too extreme, it is difficult to think and act rationally. There is a threshold- how do we judge whether a person has reached the threshold?

- If you can keep calm and listen to opinions during communication, it means that the critical value has not been reached. If the emotions are already exaggerated, it is difficult to think rationally or listen to opinions, and the communication is invalid, which means that the critical value has been approached
- You can also directly ask the visitor to rate the mood, 1-10; first determine the baseline, and then look at the changes and fluctuations to judge whether the mood is beyond the normal range
    - We cannot and cannot understand the emotional state of another person with 100% accuracy. We can ask the other party to reflect and rate themselves, which can also help them increase their understanding of their emotional state.
        - bodily sensations? Is it because many thoughts appear at the same time, my mind is spinning quickly, and I feel like I have froze.
    - If you think the visit is on the threshold, it can help cool down the mood. When people face emergencies, it is inevitable that they will not know what to do. When it comes to suicide and self-injury crisis, it will also be mentioned later. At this time, we need our staff to give direct advice and help for the visit, instead of asking what the visit needs
        - (After sitting quietly for 1-2 minutes) Let's take a deep breath together, come hold this ice pack, try holding this teddy bear, and listen to me continue. We can go out for a little walk together (if the outside temperature is low, it can achieve the function of physically cooling down the emotion)
- Document and summarize individualized criteria, emotional ladders and cutoffs that may vary from person to person

10:40-11:30 Validation and active listening skills

What is validation

- Validation can help people feel respected and understood, and it can make it easier for them to express their feelings. In counseling and therapy, emotional recognition is a very

important skill. It can help clients build trust and a sense of security, so that they can open up and we can better support and treat them.

- Validation is giving other people affirmation and understanding of their emotional experience. This includes acknowledging and respecting their emotional expressions and letting them know their feelings are understood. Empathy can be expressed through verbal and non-verbal expressions, such as affirmative comments, encouraging words, understanding questions, etc., and focused eyes.
- You can also empathize with yourself, understand yourself, pat yourself on the shoulder, and give yourself a hug.

A Few Keys to Validation

1. Validation means
    - To find the truth in another person's opinion or a situation of events; to verify the facts of a situation.
    - Recognize that a person's emotions, thoughts, and actions have reasons and are therefore understandable.
    - Empathy is not necessarily expressing agreement with another person.
    - If it is not a fact, it will not be recognized; for example: My life is hopeless. This is catastrophic thinking, not fact. Understanding can be expressed, but consent is not given.
2. Why recognize emotions
    - Validation helps improve our relationships with others because it shows that we are listening and understanding.
    - It improves interpersonal communication by reducing:
        - pressure to prove who is right
        - negative reaction
        - anger
    - Acknowledging emotions can be the first step in enhancing problem solving, bringing people closer, and providing emotional support.
    - Denying someone else's emotions hurts them and our relationships with them
    - Denying another person's emotions means not acknowledging or validating their feelings. It may include ignoring, minimizing or belittling their emotions, or telling them they shouldn't feel that way. This can hurt and damage the

relationship as it can make the other person feel incomprehensible and unsupported. It is important to practice empathic understanding and validating the emotions of others even if we disagree with their feelings to build trust, intimacy and improve relationships.

3. Be mindful when acknowledging emotions
    - Recognize only facts
    - Understand the emotions, beliefs, opinions, and thoughts of others
    - the painful plight of others

How to Validate Others' Emotions, Thoughts, and Behaviors

After each empathy skill is explained, practice in groups

1. concentrate
    - Look interested, listen and observe
    - Don't do other things on the side. Maintain eye contact. focus. Occasionally nod. Responds with the face (eg, smiling at a pleasant statement; expressing concern when hearing something painful).
2. Feedback summary
    - Say what you heard or observed to make sure you actually understood what the other person said.
    - Don't use *judgmental* language or tone!
    - Try to really "understand" the other person's feelings or thoughts. Keep an *open* mind.
    - **Don't be perfunctory [perfunctory-is to quickly end the speaker's talk, and quickly say your own suggestions and things], start from another perspective, consider the differences between yourself and the other party, and make a sincere response
        - Don't disagree, criticize, or try to change the other person's thinking or goals.
        - **Use a questioning tone** to allow the person to correct you and help you check the facts!
        - For example:

        - "So you're mad at me because you think I lied just to get back at you. Am I getting it right?"
        - A: I'm so tired. I've been working all day.
        - B: Oh, I'm tired after such a day. VS You must be tired after a busy day.

3. "Mind reading":
    - Be sensitive to what the other person is not saying. Pay attention to facial expressions, body language, what's going on, and things you already know about the person. Show with words or actions that you understand. Willing to be corrected.
        - For example:
            - When you're hoping a friend will drop by for a ride home at the end of a long day, and if the person looks tired, say, "You look really tired, I'll just take the bus back."
4. Understanding based on personal history:
    - Seek out whether the other person's feelings, thoughts, or thoughts are reasonable, given their history, mental or physical condition, or current events (i.e., reasons)
        - Even if you disapprove of the other person's actions, or his or her beliefs are incorrect. Saying "It makes sense because..."
        - For example
            - If you sent a party invite to the wrong address, say, "I can understand why you think I might have excluded you on purpose because I got the address wrong so you didn't receive my invite."
            - ***Although many people's first reaction is to dispute who is right and who is wrong, rather than first recognizing the other party's emotional reaction. The consequence of this is that the emotional reactions of both parties continue to climb, and finally reach a point where they cannot communicate.
5. Acknowledgment of current facts:
    - Show that you think the other person's thoughts, feelings, or actions are reasonable, taking into account current realities.
    - Believe that the other person's behavior is reasonable, and actively use your own behavioral responses to further convey to the other person: I understand you, so I do this.
        - For example:

- If you get criticized for not cleaning the kitchen on your day, your roommate is mad at you.
    - Acts of empathy: Acknowledge that today is your responsibility and clean up the kitchen immediately.
- If people have a problem and need help, help them out (*unless they just want to be heard*).
    - Sometimes people really just want someone to listen to their problems and difficulties, they have the ability and ways to solve them, they just need someone to understand and empathize with their emotions and situation.
    - At this time, you can ask after listening and empathizing - can I help you? suggestion? Or do something for you, like drive you home?
- If people are hungry, give them food.
- *** Also want to acknowledge and recognize people's efforts if the results are less than satisfactory.
    - Maybe the visitor tried his best to take the medicine every day, but due to various reasons, he still failed to achieve a high level of compliance. what would you say Emphasize the negative impact of non-compliance?
    - Your reply or conversation should emphasize the effort you have seen this person put in, the more detail the better, it makes them feel recognized for their efforts and sometimes receiving this response makes them more motivated to keep trying take medicine. for example:
        - I see your giving. You are using an electronic pill box, and you have asked your friends to remind you, and you have set an alarm clock on your mobile phone [Recognize your efforts].
        - Your time at work and social activities still seems to be causing some difficulty with your medication at times [acknowledging reality].
        - **It is really not easy to take medicine every day. In addition to tolerating the side effects, you must also try to maintain work and social activities. If I were you, I would find it very difficult, and sometimes I

might be a little frustrated [Recognize reality, use historical dialogue, read Heart】.

- If I can help you with anything here, feel free to say 【offer help】to me. Note here, there is generally no need to immediately list what you can help with, sometimes it makes people feel—you are missing the point, I don't need this.

6. Show equality:

    - be yourself. See each other as your equal, not as weaker or helpless than you.

        - On the other hand, it is to believe that the other person has the ability to make a change or a certain behavior, such as medication compliance.

        - In psychological work, when a client says, I don't believe in myself, the counselor will say

            - You have gone through so many difficulties (for example) in your life, and you have overcome them one by one. You have the ability, maybe the level of difficulty in front of you is higher, you have never encountered it before, you are a little uncertain.

            - It's okay, I trust you. My trust is double, and I have done yours too.

    - Let go of defensiveness: Being defensive means responding to criticism or perceived threats in a way that protects oneself, usually by denying responsibility, making excuses, or hitting back. It is often seen as a barrier to effective communication and can damage relationships. We all want to be right, and we all have good intentions, so we get defensive.

        - Our empathy may sometimes be inaccurate. For example, the emotions we think the other person feels may not be what they really feel, or the difficulties we think the other person is facing are different from their own perceptions.

        - At this time, you should let go of your point of view, *right or wrong is not important*, let go of this defensive psychology, your emotional response will be reduced, and you will be able to better ask and evaluate the situation of the visitor.

    - Be open to opinions, actively listen to and acknowledge the other person's perspective, and be willing to take responsibility for your own actions.

- Example: Willingness to admit mistakes. Ask others for their opinion. Don't offer your opinion without being asked for it. Don't just tell others what to do.

Empathy practice

1. LingXiao and LiYing demonstrated each skill
    a. Demonstration of invalidation
    b. Demonstrate validation
2. Pair staff for practice
    a. Share something that made you feel emotional, difficult in your life or work in the past 1-2 weeks.
    b. The two are the speaker and the listener, each role for 3-5 minutes, and then switch roles.
    c. In the first half of the time, the listener insisted on not doing empathy, and in the second half, he intentionally used empathy.
    d. The speaker experiences the impact of empathetic dialogue on himself.
    e. discuss
3. *Exercise showing how to use approved empathy skills to reinforce/encourage group members, similar to strengthening medication behavior
    a. Point out any techniques, emotion management, or problem-solving skills that you think the group members use
    b. Acknowledge the emotional pain, difficulty of the problem, effort they put in whether the technique was used successfully or not
    c. Admit that you have similar experiences, and whether you can inspire yourself through the sharing of group members

Session 3 syllabus: Problem solving, hope generation, and crisis intervention
Prepare: - Send course content to staff - Be ready to share empathy practice homework
10:30-10:40 Meditation practice 10:40-11:30 Problem Solving and Inspiring Hope 11:40-12:25 Suicide Screening and Crisis Intervention 12:20-12:30 **Arranging exercises after class - Practice balancing total acceptance/empathy with helping the client solve problems - Practice ways to inspire hope (in addition to using methods other than problem solving) - Familiarize yourself with and improve your crisis response and follow-up plan - Workers are paired to practice, role play, and each complete a safety plan

10:40-11:30 Problem Solving and hope generation

1-Problem Solving

- Many times the feeling of hopelessness arises because we feel that we cannot solve the problem at hand and cannot accept the reality.
- Sometimes this problem is really difficult, and more often, we can get out of this predicament by gaining the support and strength of others to solve the problem together.
- Problem solving helps group members find effective coping strategies instead of engaging in emotional behavior or making decisions based on emotions.
- Emphasis is placed on helping group members identify and define issues causing emotional or behavioral difficulties
- Balancing Total Acceptance (Empathy) and Problem Solving

How to use problem solving-key points

1. Define the problem - what exactly is the problem you are facing now? Why does this situation have such a big impact on your mood and behavior?
    a. Unemployed, can't find a job
    b. Makes me feel like a failure, incapable of living the life I want and being the bread and butter of my family
2. Clarify goals - what are the goals/results you want to achieve? What outcomes are important to you? (linked to values - family, responsibility, freedom, independence, enriching life)
    a. Find an ideal job and have certain financial ability to support yourself and your family
3. Do you know how to achieve this goal / achieve this result?
    a. don't know/not sure
        i. Brainstorm together to find ways and means to solve the problem (write down as many solutions as possible)
            1. When a situation seems impossible, do we need to make it look less difficult?
            2. Have you ever encountered a similar problem and how did you solve it?
            3. Think about the people around you. Is there any example that you can refer to? How did they solve the problem when they encountered it (or how do you think they would solve it)

4. What resources are available around you? (For example, experience posts on the Internet, various job-hunting platforms, etc.)

ii. Then move on to the motivators/blockers

b. have a clear plan

i. What factors will help you implement this plan? - Momentum factor

1. Someone reminds/urges me to search for jobs and submit resumes every day

2. Proud to think of being able to provide financial support for my family

ii. What factors are preventing you from implementing this plan? - hindering factors

1. Emotions of loss and fear hindered rational thinking and action, and thinking of the disappointed faces of friends and family made it difficult for me to summon the energy to submit a resume.

4. *** Anticipate problems and prepare solutions in advance

a. Use problem solving early to reduce anxiety and increase confidence in coping with problems

b. listed on the list

i. Frequently asked questions during visits: drug side effects, difficulty in compliance, reactions from family and friends

ii. Prepare corresponding solutions to problems

iii. Practice coping plans

1. Take your daily vitamins regularly and practice medication adherence until you get your test results and medication

2. Prepare some countermeasures in advance according to the side effects of different drugs

a. Insomnia - Sleep Music

3. Read popular science articles related to transmission channels

4. practice total acceptance

7 Steps to Problem Solving - DBT Problem Solving

Teachers, please give a common question about visits at work. We can use the problem-solving method to systematically help the visits to solve the problems.

1. Clearly describe current events and situations:
    a. Distinguish between the event itself and the thoughts, emotions, and understandings related to the event, and observe the changes in the body, thoughts, and emotions caused by the event
    b. Why the current situation is causing you problems/why it bothers you, including any follow-up problems the event or situation may cause you
        i. Not only does being sick itself have an emotional effect on me, it also makes it difficult for me to concentrate at work and therefore may affect the quality of my work.
        ii. Always being misunderstood by a friend and causing disputes makes me feel annoyed, and I don't want to have any interaction with this friend anymore.
    c. What are the possible obstacles and difficulties in solving the problem
        i. I do not have enough income to buy medicines with fewer side effects
        ii. I don't have many friends and I'm terrified of losing this friend if I get estranged from her.
2. Mapping emotional responses to event conditions
    a. The future holds many possibilities; step out of extreme thinking
    b. Events vs Understanding Events
        i. Many times our emotional responses are not triggered by the event itself, but by understandings and thoughts related to the event. Our understanding of events may be inaccurate and we need to check our thinking.
    c. How much the current situation and events affect us emotionally-how stressing is the situation
        i. Many times we may catastrophize one thing and think about it very seriously. At this time, fully accepting the reality and using the skills to deal with extreme emotions can help us cool down the emotions, suspend further catastrophizing the understanding of the event, calm down, measure and think about the problem objectively.
    d. Are the obstacles and difficulties that I think are really insurmountable obstacles that lead to problems that cannot be solved?

i. When our emotions are extreme, it is easy to magnify the obstacles in front of us because of the influence of emotions. For example, when your emotions themselves are extreme, a heated argument with a friend may seem like a trivial matter when you calm down and think about it.

3. * What is the benefit to you of clearly solving the problem, and what can it help you achieve?
    a. What is the purpose of solving the problem, and write down the goals you can achieve in a simple and clear way. Possibly alleviating emotional pain is one of the purposes.
    b. What if solving problems is just for solving problems? Nothing to do with emotions, maybe? ?
        i. Find a way to get the medicines I need, and if that's not possible, find a way to improve and improve the quality of my work.
        ii. Find ways to make friends understand me better, or at least misunderstand me less often
4. * Brainstorming ways to solve problems
    a. As many, creative solutions as possible
    b. A solution to a problem can consist of one or more steps or behaviors that help us reach our goal
        i. If you are troubled by side effects, you can tolerate them, try to accept them, ask your doctor about ways to alleviate them, change medications and treatments, reduce side effects, and ask friends about possible solutions.
    c. So attention is good attention, no limit
        i. Write down all the notes that come to mind, the more notes you have, the more likely a good idea will come to you.
        ii. Don't think too much at this stage, and don't need to think about whether it is realistic.
5. Choose a solution that is likely to solve the problem
    a. Ranked according to the likelihood and practicality of solving the problem
    b. Evaluate the pros and cons of the program

	plan 1	Scenario 2
advantage		
shortcoming		

6. * Implement the solution, taking into account possible barriers in advance
    a. Excuses/Laziness: It's too hard; I'm too tired; I don't have time
    b. Fear-inducing thoughts: If the project doesn't work out, I'll look like a failure; people will be mad at me
    c. Stubbornness/Stubbornness: Obviously I didn't cause the problem, why should I solve it?
    d. Impulsive/impulsive: impulsively try to solve the problem immediately under the influence of emotions, without careful consideration
7. Evaluate the results of implementing problem solutions
    a. Am I not satisfied with this result? Do I feel better now than before? Has it had a negative impact on yourself or others?
    b. Even the best plans can go awry. Unexpected obstacles or problems may arise. We need to reflect after implementing the plan and consider how to further improve the plan.
    c. An effective problem-solving process often requires multiple attempts at different solutions and constant evaluation of the results of plan implementation. This process requires a lot of patience.
    d. The first attempt often won't completely solve the problem, but at least it can improve the current situation slightly. On this basis, use other methods to continue to solve other aspects of this problem.

2- Hope generation

- Sometimes, because the problem at present seems to be unsolvable, so the feeling of ***despair***.
- Hope is a force that makes us believe that the future will be better, and it can give us courage and strength to face difficulties. When we feel hopeless, hope can give us new hope and opportunity. Hope enables us to see a bright future and fight to make it happen.
- Hope is one of the most important things in our life, it can give us the strength to keep

going until we reach our goal.

KEY POINTS AND EXAMPLES TO INSPIRE HOPE

- To help solve the problem, follow the above steps
    - Part of the problem may be resolvable; for the rest, it may be necessary to accept it temporarily, alleviate the pain, and gradually improve the status quo.
        - Example of a breakup.
- Emphasize ability and regain self-confidence
    - For example: You have gone all the way, overcome so many difficulties, and came to this city to start your own work and life. How difficult it is. You can come here, which shows that you have the ability to face all kinds of difficulties in life. capacity for emergencies.
- Uncover who/thing/life purpose they hold dear
    - Have you always wanted to study in Japan?
    - I remember you wanted to share your experience with more people and help them? I believe that there must be many people who can be helped by your sharing and regain their confidence in life.
    - Start learning to cook tomorrow
- Help them see the way forward/reach their goals
    - Example: Being sick can have some effect on your life, it does. While your life is restricted, you can still live a rich and valuable life, and you can still have many cherished friendships, family ties, and enjoy delicious food. Dance in shackles.
- Help them find reasons to live/reasons not to commit suicide, link to point 2 above
    - Is there anyone or something you love that you can’t and can’t let go of?
    - If you were to leave this world, what would you not let go of?
    - What still binds you to remain in this world?
    - People around you (family/friends/partner) may have regarded you as their role model, and their life trajectory will also be affected by your behavior. Are you willing to use your behavior to bring positive influence to them?
        - If you were to leave this world, what kind of example do you think you would set for them? What kind of impact will it have on them?
- If it is difficult to find purpose in life, help them create meaning in life
    - Get a pet, haven't you always said that you like cats and dogs very much?

    - Chicken Soup for the Soul book or movie recommendation

- Any of the above needs to be followed up, and there must be very specific steps. For example, if you have a pet:

    - What kind of pet would you like to have? Do you know where I can buy puppies/cats? Let's search the Internet together now. You can make a phone call and ask your friends if they know? Drive there tomorrow, the sooner the better. First prepare cat food, bed, and toys, and then find a veterinarian to vaccinate the cat. Send me a photo after you buy it, I like cats~

11:40-12:20 Suicide Screening and Crisis Intervention

1- Usage

a. Suicidal/Self-Harm Thoughts Reported on the PHQ-9 Depression Scale for Two Weeks

b. Mention of suicidal/self-harm thoughts or intentions in study groups or conversations

2- Specific steps

	past month	
Please answer questions 1 and 2 below	yes	no
1. Have you ever wished you were dead or wished you could sleep without waking up?		
2. Have you ever had suicidal thoughts and intentions?		
If answer 2 is yes, proceed to 3, 4, 5, 6. If answer 2 is no, go directly to question 6		
3. Have you thought about how to implement these ideas? For example: "I've thought about taking an overdose, but I've never made a concrete plan about when, where, or how I'll actually do it, and I never will."		
4. Have you had any of these thoughts and planned to act on them? (Instead of, "I have these thoughts and I will never do anything about them")		
5. Did you start planning or working out the details of your suicide? Are you going to implement this plan?		
6. Have you ever done anything, started anything or prepared to do anything to end your life? Examples: taking drugs, trying to kill yourself, cutting yourself, hanging yourself, taking out a drug but not swallowing it, holding a gun and changing your mind or being snatched from you, going to a roof but not jumping, collecting drugs, getting a gun, sending a precious items, writing a will or suicide note, etc.	ever or forever	

If the answer to 6 is yes	past three months	
7. Did this behavior occur within the past three months?		

3- Referral Program

risk level	Referral Program
level one	The staff followed up for 1-2 weeks to help solve problems, stimulate the hope of life in the group members through dialogue, and recognize emotions and pain - Acknowledging emotions and pain - Acknowledging emotion refers to giving others affirmation and understanding of their emotional experiences. This includes acknowledging and respecting their emotional expressions and letting them know their feelings are understood. - Emotional validation can help people feel respected and understood, and can make it easier for them to express their feelings. Emotional recognition is an important skill in counseling and therapy, helping clients build trust, safety, and support. - Verification can be reflected through verbal and non-verbal expressions, such as affirmative comments, encouraging words, comprehension questions, etc., and focused gaze. - Solve the problem and fully accept: - Many times the feeling of hopelessness arises because we feel that we cannot solve the problem at hand and cannot accept the reality. Sometimes this problem is really difficult, and more often, we can get out of this dilemma by enlisting the support and strength of others. - inspire hope: - Hope is a force that makes us believe that the future will be better, and it can give us courage and strength to face difficulties. When we feel hopeless, hope can give us new hope and opportunity. Hope enables us to see a bright future and fight to make it happen. Hope is one of the most important things in our life, it can give us the strength to keep going until we reach our goal.

Secondary	Follow up Provide community mental health resources Provide the contact information of Shanghai Mental Health Center
Level three	Follow up Develop a safety plan with team members, and tell at least one family member/friend

4- Suicide Crisis Response Program (Therapists' survival guide)

When the client is in a suicidal crisis, short-term intervention can be carried out according to the following steps. At this time, as a staff member, facing this situation, you may feel overwhelmed, you may feel fear, fear, and anxiety, which are all understandable. Remain calm, express understanding and empathy for the pain of the client, provide psychological comfort, and help them through the crisis through positive advice and dialogue.

Intention, plan, and approach, if two of the three are present, the risk level is higher (level 2 or level 3)

Here are the principles for your reference:

- When the risk level is higher, the dialogue should be more proactive, for example, offer suggestions-"You have to walk down the stairs now, otherwise we can't talk calmly".
- During the dialogue, it is not necessary to follow the prescribed steps, but to be flexible according to the situation.
- The dialogue should be sincere and honestly explain the reasons behind the answer (for example, when a visitor asks why a certain action is performed, the reason for the action should be explained frankly)
    - Follow up with the previous one: You can't just say that to trick him to go downstairs, there may be a police car or family members waiting below, and he won't give him a chance to calmly talk at all.

Specifically, you can follow these steps to evaluate and provide immediate psychological assistance:

1. Timeliness and severity of suicide/self-harm risk assessment
    a. Find problems now, without delay

i. What puts the client in crisis? Summarize the problems encountered by the visitor

1. Example: Directly ask the client what makes him want to end his life?

2. Answers that may be given by the visitor: sudden unemployment, family breakdown, being cheated of money/emotions, etc.

b. Focus on solving the most pressing problems of the moment

i. Emphasize and instruct clients not to take suicidal actions

1. Example: If the visitor stands on the roof and wants to jump off the building, first persuade him to stay away from the edge of the roof

ii. Emphasize that suicide is not an effective solution to problems

1. Example: Suicide has no way to change and save the loss caused by unemployment, but it will make those who care about you suffer and cause greater loss;

iii. Make suggestions and give specific instructions directly to clients

1. Example: I suggest you come down from the rooftop first, tell me about this incident, and let your emotions ease. The result of impulsiveness is only regret.

iv. Based on the client's skills, provide feasible solutions to enable them to use the skills

1. Example: I know you have a good relationship with your partner, and you are also good at communicating with him. Would you like to tell him about the difficulties you encountered, maybe you can think of a solution together?

v. Emphasizes, clarifies, and reinforces adaptive or effective behaviors that have helped the client, including the client's past effective ways of coping with problems

1. Example: Confirm that the visitor leaves the rooftop, encourage him to go home first and communicate with his partner, and at the same time guide him to recall how he solved and spent similar problems in the past

c. inspire hope

i. Help clients create hopeful statements, such as "The pain and crisis I am experiencing now is only temporary, and with the help of those around me and my efforts, the future will definitely get better"

ii. Focus on the motivation and reasons for the client to live, such as family concerns, partner love, etc., future travel plans, etc.

d. Pay attention to and stabilize the client's emotions

i. We solve the problem slowly. When the emotions are so strong, the brain does not work, and we cannot solve the problem in a short time.

ii. Guide the visitor to pay more attention to the current emotion, mainly to *stabilize the emotion*.

iii. When the client falls into negative emotions, immediately recognize and appease him, and don't rush to solve the problem

iv. If the mood has eased, help the client adjust and rebuild the perception of the event, and provide encouragement and support

v. Teach and guide clients on techniques for immediate emotional management (e.g. deep breathing, physical cooling, etc.)

vi. Focus on improving emotional tolerance (especially for extreme negative emotions such as pain and anger)

e. Reduce high-risk environmental factors

i. Remove deadly suicide pathways, or allow client to self-clear

1. Example: Take away sharp objects, supervise visitors not to go to high places, etc.

ii. Remove or boycott suicide samples/examples/images

1. Example: A detailed description of the recent suicide behavior. If you start thinking about these plans again, find a way to distract yourself; many times the reason why we have these thoughts and plans is because we feel that the problems in front of us cannot be solved, so we end our lives Is the only way, or or the pain is unbearable, only death can end these pains.

iii. enhance social support

1. From you or others, it can be visiting family members, friends, partners, or psychological counselors, social workers, etc.

iv. Temporarily remove or reduce stressful events and demands

1. Example: A friend keeps asking the visitor for help, which makes the visitor very stressed. At this time, you can help the visitor to properly refuse the friend's request first.

2. Example: Work pressure is very high, the relationship with colleagues is tense, and classmates bully at school.

f. Reduce current high-risk behaviors and immediate/immediate risk factors

i. Activate client's adaptive behaviors (e.g. emotion management, seeking social support, etc.)

ii. Stop the client's current maladaptive reactions (eg, excessive drinking, self-isolation, etc.)

iii. Identify the function of the client's current suicidal ideation (such as attracting others' attention, avoiding problems, or solving problems, etc.)

1. Help the client realize that suicide is not a good solution to the problem and that there are other ways to achieve the same goal

g. Assess the intensity of suicidal thoughts/intentions/plans, on a scale of 1-5, and compare with the time of acceptance of the conversation to see if there has been any change;

2. Through dialogue, make the client commit to implementing the action plan developed together to ensure safety

a. Explicitly ask client to commit/pledge to act

i. Example: Ask the client to reassure you that they will call their partner first the next time they experience suicidal thoughts

b. Get the client to commit to implementing the safety plan

i. Example: If I feel lonely and have suicidal thoughts, I will call my friends first. People who can call include, 1, 2, 3. I can also distract myself by exercising, music, eating food, etc. until the next day when I go to work/class/time to meet with a consultant.

c. Makes many demands/high expectations, but accepts promises/behaviors that fall short of expectations.

i. Example: Ask the visitor to list as many plans as possible (see previous example), but it's okay if only one or two of them end up being done

d. Remind client of previous commitments made

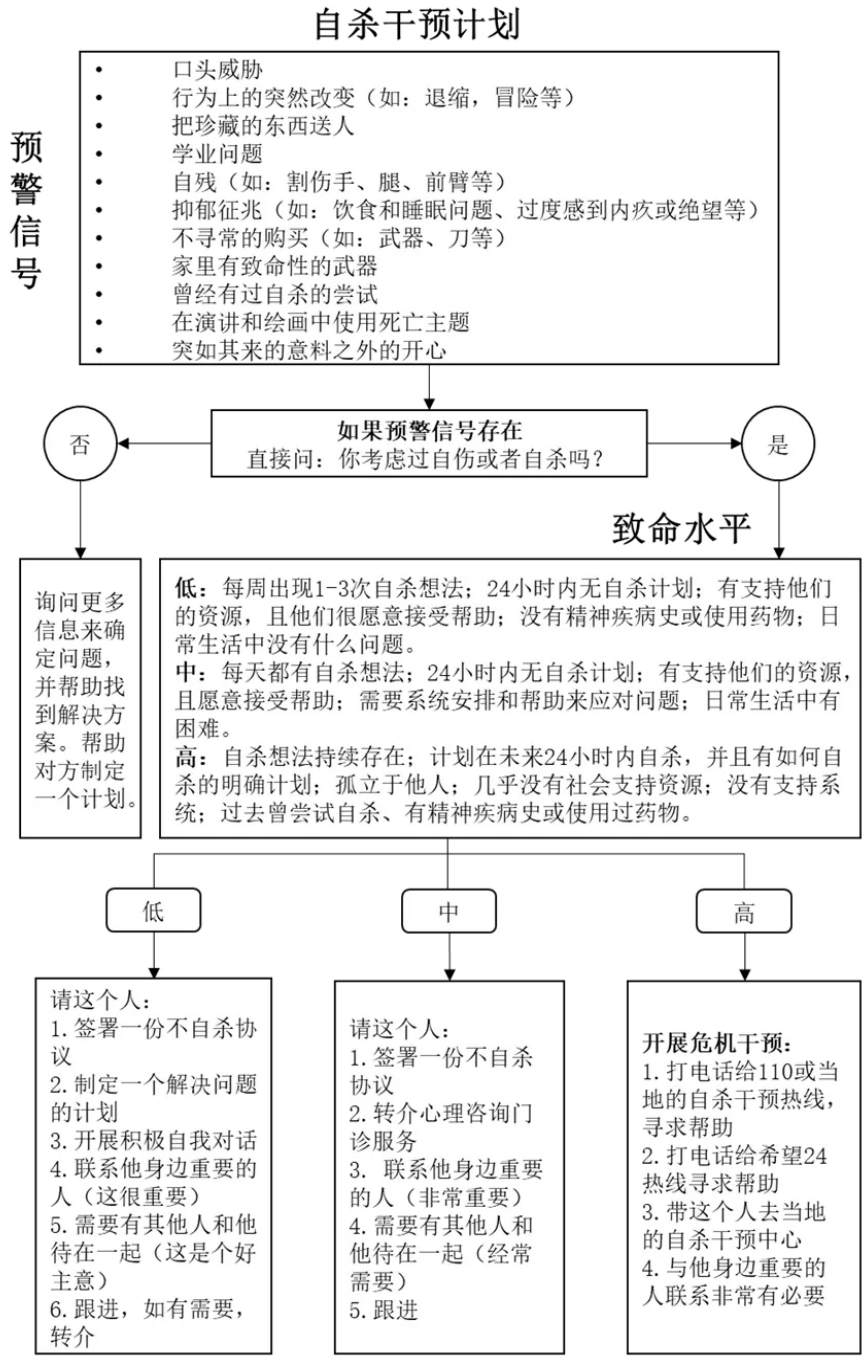
i. Example: I remember you saying that next week you were going to see a counselor/go to work on time/have a coffee appointment with a friend

e. Inform clients of their right to have choices about their lives and to think about the negative consequences of making suicide/self-harm choices

i. Example: If you really want to hurt yourself/end your life, no one can stop you, but I still hope you seriously consider the consequences of doing so, such as your family/partner will be very sad, and no one will take care of you from then on And stay with them...is this really what you want to see?

3. Pre-rule potential problems with action plans
    a. Help client identify factors that may interfere with course of action in the next hours/days
        i. Example: The action plan includes asking your partner for help when you have extreme emotions, but your partner is too busy at work and may not be able to answer the phone/come to you in time, etc.
    b. Help clients find solutions to potential problems
        i. Example: If the client cannot immediately seek help from those around him when he encounters extreme emotions, he can first try to cool down his emotions (such as through high-intensity exercise, etc.)
        ii. If the route of suicide or self-harm has been identified, it can be found at
    c. If there are problems with the original action plan or it is difficult to implement, it can help the visitor to revise or formulate a new plan
4. Before closing the conversation, reassess the risks
    a. Assess intensity of suicidal thoughts/intentions/plans, score 1-5
5. Be prepared to respond to another/repeated crisis
    a. Repeat the above steps

5-Suicide Intervention Flowchart



6- Follow-up plan

Why follow-up: If the risk level is low, the follow-up process can observe the emotional state of the team members to ensure that it will stabilize in the next period of time, the intensity of suicidal thoughts and intentions will decrease, whether the risk of suicide has changed, whether social support is necessary Create a safety plan

The key questions that must be asked during follow-up visits can be flexibly reduced or added according to the situation

1. Suicide Risk Follow-up

If the intensity of thought/intention has increased significantly compared with the previous measurement, or there is a plan or details for the next step, implement psychological assistance and proceed to the next step according to the referral plan.

    a. Suicidal thoughts, intentions, intensity: 1-5

    b. Related plans or details?

2. emotional state

    a. How's your emotional state lately? How has it changed from a week ago?

    b. Is there anything pleasant happening in life?

3. Emotion management skills and distress tolerance skills, including the use of social supports

    a. Did you use any techniques or methods that helped you?

        i. marvelous! Compared to the last time, I can feel that you are trying to use the support of your friends to make yourself feel less lonely and hopeless. 【Or the purpose achieved by other skills + skills】

    b. Which friends or family members or colleagues care about you?

4. inspire hope

    a. Is there someone or something you love deeply that you don't want to give up?

    b. Who or what connects you deeply and makes you want to move on to the next day?

    c. If you're gone, what in this world do you still miss?

    d. Inspire future words and expectations based on previous conversations and what you know about the person, such as

        i. You said before that you want to travel to Japan? The cherry blossoms in spring there are really beautiful

        ii. I remember you said you had a good friend who was about to have a baby, did you say you wanted to visit her?

        iii. Your daughter is still in high school? What will they think when they hear the news?

5. Others: Refer to the Basic Principles of the Telephone Counseling Program

7- Safety Plan Stanley Brown

Step 1: Warning signs - such as when you have suicidal thoughts

1. _____
2. _____
3. _____

Step 2: Internal Coping Strategies - Things I can do to divert my attention from contacting others:

1. _____
2. _____
3. _____

Step 3: Distracting people and social settings can be provided:

Name: _____ Contact: _____

Name: _____ Contact: _____

Location: _____ Location: _____

Step 4: People I can turn to in times of crisis:

Name: _____ Contact: _____

Name: _____ Contact: _____

Name: _____ Contact: _____

Step 5: Professionals or agencies I can contact in a crisis:

Clinician/Agency Name: _____ Phone: _____

emergency contact:_____

Clinician/Agency Name: _____ Phone: _____

emergency contact:_____

Local Emergency Department: _____ Emergency Department Address: _____

Emergency Department Phone: _____

Suicide prevention telephone hotline: (teachers are required to write down some commonly used telephone numbers in Shanghai area or in China)

1. _____
2. _____
3. _____
4. _____

Step 6: Make the environment safer (remove means and means of suicide):

1. _____
2. _____
3. _____

Session 4 syllabus: Study and app overview, online skills group logistics

Prepare:

- Send course content to staff
- Embrace Sunshine Mini Program Introduction and Usage Permissions

Meditation

Review homework

- Safety plan

Remaining practice:

- empathy level
- crisis intervention
- two-step empathy

Ling Xiao

- Share training notes and medication script

Research presentation (slides in Chinese);

- group structure; telephone consultation; weekly supervision;
- Study schedule, planning time and group flow

Mini Program Introduction and give app access

- collect WeChat ID; give app access

Group interview appointment time

- Two groups; sometime next week
- Training Feedback and Ideas

Q&A

to do

- Set up shared folder tencent
- Upload all training materials
- Start prepping group materials and guidelines
- Give staff access to WeChat

Appendix 2. Interview scripts for intervention acceptably, feasibility, and app usability

Intervention group participants study exit interview

Acceptability

Foreword: Thank you for participating in our study. The long-term plan is to gradually establish community-based mental health services and programs in partnership with Heart Health and other community organizations. In order to further improve the project content, we value your feedback.

General

1. What were your expectations for this study before you participated in the study~
2. What are your takeaways from this research?
    a. Overall overview, then specific probe
        i. Which learned skills or mental health knowledge are more helpful to your work?
        ii. What content or skills do you actively apply and practice in the future? (4-25)
3. Compared before and after training, what changes did you notice?
    a. Confidence and ability to provide psychological support to clients?
    b. Do you feel there is a need for this before participating in the research?
    c. Did you feel more equipped (or more confident/prepared?) to deal with emotional difficulties after the study?

Content & app

4. What do you think of the content of emotional mental health presented in the study? What is good, what is not, and how can it be improved?
    a. what help? How did it help you?
        i. To what extent do you think this project has met your expectations in terms of helping to understand and resolve emotional distress?
        ii. To what extent can it meet your daily needs?
    b. Where is it lacking? What improvements can we make in terms of content to make this mini program content more helpful to you?

i. Which ones are not enough? Which talk too much?

c. *Ask about content improvement from these aspects*

i. Difficulty/ability to understand

ii. level of attractiveness/interest

iii. (emotion regulation skills) usefulness

iv. Subject categories/coverage and depth

5. To what extent did you apply the skills you learned to help improve your emotional state during the four-week study?
    a. If yes, please describe with examples what technical content was applied?
6. How do you feel about the format of a podcast?
    a. Other preferred formats?
    b. Other anti-podcasts?
7. Feedback on overall use of the Mini Program
    a. Tracking features

Online skills group

8. What are your thoughts on online study groups?
    a. content, process, structure
    b. Communication and interaction among team members
9. Foreshadowing: Our teachers have received some training in advance, in terms of content and overall psychological counseling skills.
    a. What is the ability and performance of the leading teacher? What are some good ones? What needs to be improved?

Willingness

10. If we will launch new content on the Mini Program in the future, would you be willing to participate?
    a. What about online study groups? Do you think it is mandatory or optional?

11. Would you recommend other people you know to use our Mini Program?
    a. What about study groups?

Feasibility

Overall training program

12. [Small program self-study + online group] How feasible is this form to implement?
    a. May include: flexibility, burden,
13. Given the events of your life, how can our mental health services be tailored to meet your needs without placing an undue burden on you?
    a. group frequency, group duration
14. Measurement burden (added 04-30-23)
    a. Too much to do?? Weekly followup + weekly homework

Burden

15. What is the burden of participating in the training on your other work responsibilities and life, is it relatively heavy or manageable?
    a. Having trouble participating in our research outside of work?
    b. Do you take time each week to learn additional psychological support skills in addition to completing your research?
        i. If yes, why would you want to take the extra time to learn about it?
        ii. How much time?

Overall

16. Overall, how satisfied are you with the mental health support services designed for the study? rating 1-10
    a. Is the effort you put into the project equal to your gains? (Why/Why not)
    b. Is the pay and harvest proportional?
17. Closing question: Do you have any other comments and suggestions for this project?

SCMC staff post-training interview

Acceptability

General

1. What did you gain from this training?
    a. Which skills or mental health knowledge learned in the training are more helpful to your work?
    b. What content or skills do you actively apply and practice in the future? (4-25)
2. Compared before and after training, what changes do you think?
    a. Confidence and ability to provide psychological support to clients?
    b. Do you think there is a need for this before the training?
    c. Do you feel more equipped (or more confident/prepared?) after the training to help clients cope with emotional difficulties (provide psychological support)?

content

3. How do you think this training has helped you in your work on psychological support?
    a. what help? How did it help you?
        i. To what extent do you think this training has met your (heart-born) expectation in terms of helping the client resolve their emotional distress? To what extent can the needs of visitors be met?
    b. Where is it lacking? What improvements can we make in terms of content to make the training more useful to you?
        i. Which ones are not enough?
        ii. Which talk too much?
    c. *Ask about content improvement from these aspects*
        i. Difficulty/ability to understand
        ii. level of attractiveness/interest
        iii. (emotion regulation skills) usefulness
        iv. Topic category/coverage and depth (does it allow you to effectively impart skills and assist visitors)

4. In your work with visitors within 1-2 weeks after the training, have you applied the skills you have learned to help the visitors or help yourself? (4-14)
    a. If yes, please describe with examples what skills or training content was applied?

Instructor capability

5. Foreshadowing-Self-introduction-need honest feedback-humility-to improve
    a. What are my abilities and performance? What are some good ones? What needs to be improved?

Willingness

6. If we have in-depth training in the future, would you like to participate?
7. Will you join other colleagues or people you know in our future trainings?

Feasibility

Overall training program

8. How feasible is the training program to be implemented?
    a. May include: flexibility, burden, institutional support
9. Given your other job responsibilities, do you have any suggestions for our project flexibility?
    a. training period
    b. training time
    c. Training process and structure: Started with meditation, review assignments, new content, paired exercises, wrap-up/questions

Burden

10. How burdened is the training (two hours per week plus homework for you) on your other job responsibilities and outside of life, is it relatively heavy or manageable?
    a. Is it difficult to participate in our training outside of work content?
    b. Do you take time each week to learn additional psychological support techniques in addition to the training?
        i. If yes, why would you want to take the extra time to learn about it?

ii. How much time?

Institutional support

11. How much does Shanghai Xinsheng (SCMC) support you in participating in this training?
    a. Need more support? What kind of support?
12. To what extent have your work affairs (SCMC or other work units) affected/or caused difficulties?
    a. Ability to attend training?
    b. Ability to learn psychological support skills?

Overall

13. Overall, how satisfied are you with our training? rating 1-10
    a. Is the effort you put into the training equal to your gains? (Why/Why not)
    b. Is the pay and harvest proportional?
14. Closing question: Do you have any other comments and suggestions for this training?

Appendix 3. Regression results for subscales

Table 1. Adherence outcomes[1]

	Adherence (Total)			Number of days missed medication			Adherence well following instructions			Adherence frequently		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	99.36	98.67 – 100.05	<0.001	98.67	97.54 – 99.79	<0.001	76.39	63.04 – 89.75	<0.001	87.05	77.54 – 96.57	<0.001
timepoint	-0.11	-0.27 – 0.06	0.204	0.06	-0.18 – 0.31	0.61	-0.76	-3.74 – 2.22	0.61	-0.76	-2.97 – 1.45	0.492
tx	-0.12	-1.07 – 0.84	0.809	1.51	-0.06 – 3.07	0.058	1.33	-17.21 – 19.88	0.886	0.57	-12.64 – 13.79	0.931
timepoint:tx	0.18	-0.04 – 0.41	0.111	-0.24	-0.59 – 0.10	0.168	3.24	-0.91 – 7.38	0.123	1.82	-1.25 – 4.89	0.239
Random Effects												
σ2	0.7			1.59			228.89			125.84		
τ00 pid	0.39			1.51			201.45			86.68		
ICC	0.36			0.49			0.47			0.41		
N pid	27			27			27			27		
Observations	54			54			54			54		
Marginal R2 / Conditional R2	0.072 / 0.403			0.070 / 0.523			0.095 / 0.519			0.057 / 0.441		

[1]All outcomes presented in the table are continuous after linear transformation.

Table 2. Quality of Life

	Overall function	Sexual functions	Disclosure worries

Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	27.29	24.34 – 30.23	<0.001	9.21	7.71 – 10.72	<0.001	9.62	6.65 – 12.60	<0.001
timepoint	-0.07	-0.65 – 0.51	0.807	-0.07	-0.35 – 0.21	0.614	0.02	-0.37 – 0.41	0.927
tx	-1.02	-5.05 – 3.01	0.614	-0.37	-2.43 – 1.69	0.72	1.28	-2.79 – 5.35	0.531
timepoint:tx	0.06	-0.74 – 0.85	0.889	0.1	-0.28 – 0.49	0.597	-0.05	-0.58 – 0.48	0.854
Random Effects									
σ2	9.46			2.23			4.19		
τ00 pid	14.77			4.3			24		
ICC	0.61			0.66			0.85		
N pid	30			30			30		
Observations	60			60			60		
Marginal R2 / Conditional R2	0.008 / 0.613			0.002 / 0.659			0.012 / 0.853		
	Health worries			**Financial worries**			**HIV mastery**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	14.82	11.94 – 17.71	<0.001	9.71	7.43 – 11.99	<0.001	10.39	8.65 – 12.14	<0.001
timepoint	-0.39	-1.06 – 0.27	0.243	-0.07	-0.52 – 0.38	0.753	-0.11	-0.37 – 0.16	0.423
tx	-2.23	-6.18 – 1.72	0.263	1.63	-1.49 – 4.75	0.3	-0.85	-3.24 – 1.55	0.482
timepoint:tx	0.49	-0.43 – 1.40	0.291	-0.15	-0.77 – 0.47	0.636	0.37	0.01 – 0.74	**0.045**
Random Effects									
σ2	12.41			5.73			1.97		
τ00 pid	8.79			8.8			7.44		
ICC	0.41			0.61			0.79		
N pid	30			30			30		
Observations	60			60			60		
Marginal R2 / Conditional R2	0.021 / 0.427			0.031 / 0.618			0.020 / 0.795		
	Life satisfaction			**Medication worries**			**Provider trust**		

Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	29.18	25.70 – 32.66	<0.001	13.5	11.69 – 15.31	<0.001	10.57	8.58 – 12.57	<0.001
timepoint	-0.18	-0.72 – 0.36	0.51	-0.07	-0.49 – 0.34	0.731	-0.14	-0.55 – 0.27	0.486
tx	-3.91	-8.67 – 0.85	0.105	-0.19	-2.66 – 2.29	0.88	0.13	-2.60 – 2.86	0.923
timepoint:tx	0.85	0.11 – 1.59	**0.025**	0.07	-0.50 – 0.64	0.802	0.19	-0.37 – 0.75	0.499
Random Effects									
σ2	8.11			4.8			4.64		
τ00 pid	28.92			3.56			6.31		
ICC	0.78			0.43			0.58		
N pid	30			30			30		
Observations	60			60			60		
Marginal R2 / Conditional R2	0.039 / 0.789			0.001 / 0.426			0.015 / 0.583		

Table 3. Difficulty in Emotion Regulation

	Strategies			**Non-acceptance of emotions**			**Emotion-related impulse**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	6.49	5.02 – 7.95	<0.001	6.34	4.81 – 7.86	<0.001	4.99	3.69 – 6.28	<0.001
timepoint	0.07	-0.17 – 0.31	0.561	0.14	-0.15 – 0.42	0.35	0.07	-0.13 – 0.27	0.48
tx	0.21	-1.80 – 2.22	0.836	1.09	-1.00 – 3.17	0.304	0.81	-0.97 – 2.58	0.371
timepoint:tx	-0.27	-0.60 – 0.06	0.114	-0.48	-0.88 – -0.09	**0.016**	-0.24	-0.51 – 0.04	0.089
Random Effects									
σ2	2.1			2.93			1.43		
τ00 pid	5.39			5.07			4.44		
ICC	0.72			0.63			0.76		
N pid	30			30			30		
Observations	148			148			148		
Marginal R2 / Conditional R2	0.017 / 0.724			0.022 / 0.642			0.006 / 0.759		
	Impact of emotions on goals			**Awareness of emotions**			**Clarity regarding one's emotions**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	6.26	5.01 – 7.52	<0.001	9.69	8.11 – 11.27	<0.001	5.87	4.49 – 7.25	<0.001
timepoint	0.12	-0.13 – 0.37	0.338	-0.14	-0.47 – 0.20	0.423	0	-0.30 – 0.30	1
tx	0.54	-1.17 – 2.25	0.535	0.11	-2.05 – 2.28	0.917	0.86	-1.04 – 2.75	0.373
timepoint:tx	-0.37	-0.72 – -0.03	**0.032**	-0.03	-0.49 – 0.43	0.886	-0.16	-0.58 – 0.25	0.436
Random Effects									
σ2	2.23			3.99			3.28		
τ00 pid	3.16			4.53			3.24		
ICC	0.59			0.53			0.5		
N pid	30			30			30		
Observations	148			148			148		
Marginal R2 / Conditional R2	0.030 / 0.598			0.006 / 0.534			0.010 / 0.501		

Table 4. Coping Self-Efficacy

	Problem-focused coping			**Emotion-focused coping**			**Obtain support**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	47.3	41.60 – 53.00	<0.001	29.49	24.71 – 34.28	<0.001	19.06	14.98 – 23.14	<0.001
timepoint	-0.09	-1.08 – 0.91	0.865	-0.29	-0.96 – 0.37	0.384	0	-0.54 – 0.54	1
tx	2.46	-5.34 – 10.26	0.535	-2.23	-8.78 – 4.32	0.502	-2.99	-8.58 – 2.59	0.291
timepoint:tx	-0.27	-1.64 – 1.10	0.696	0.97	0.06 – 1.88	**0.038**	0.82	0.08 – 1.57	**0.031**
Random Effects									
σ2	35.48			15.74			10.62		
τ00 pid	77.21			64.64			47.93		
ICC	0.69			0.8			0.82		
N pid	30			30			30		
Observations	148			148			148		
Marginal R2 / Conditional R2	0.007 / 0.687			0.008 / 0.806			0.014 / 0.821		

Table 5. HIV-related stigma

	Personalized stigma			**Disclosure concerns**			**Concerns about public attitudes**			**Negative self-image**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	7.92	6.66 – 9.18	<0.001	10.52	9.51 – 11.53	<0.001	10.97	10.02 – 11.92	<0.001	7.07	5.63 – 8.51	<0.001
timepoint	0.06	-0.15 – 0.28	0.563	-0.01	-0.19 – 0.18	0.94	-0.29	-0.45 – -0.12	0.001	-0.03	-0.22 – 0.17	0.774
tx	0.71	-1.02 – 2.43	0.42	-1.15	-2.53 – 0.23	0.101	-0.14	-1.44 – 1.17	0.836	0.3	-1.67 – 2.28	0.762
timepoint:tx	-0.05	-0.36 – 0.25	0.719	0.18	-0.08 – 0.43	0.18	0.11	-0.11 – 0.34	0.327	-0.06	-0.33 – 0.21	0.667
Random Effects												
σ2	1.72			1.25			0.99			1.38		
τ00 pid	3.8			2.26			2.17			5.93		
ICC	0.69			0.64			0.69			0.81		
N pid	30			30			30			30		
Observations	148			148			148			148		
Marginal R2 / Conditional R2	0.014 / 0.693			0.036 / 0.656			0.037 / 0.699			0.002 / 0.812		