
Case Study of Adapting a Phone-based Support System to Enable Drug-dependent Patients to Develop Coping Skills

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Abstract

This paper describes a case study of adapting a phone-based support system (CopeDiary) to help drug-dependent patients obtain, maintain, and practice coping skills for dealing with high-risk situations, thereby preventing drug relapse. We designed and implemented CopeDiary and conducted real-world user testing on three recovering drug-dependent patients receiving outpatient abstinence treatment at a hospital. CopeDiary was designed to be an assistive tool for therapists to educate drug-dependent patients about coping skills. Follow-up interviews revealed design-related challenges regarding how to engage drug-dependent patients and therapists about learning and teaching coping strategies for daily life.

Author Keywords

Mobile support system; drug addiction, coping skills.

ACM Classification Keywords

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Introduction

Drug-dependent people are less likely to recover from addiction by stopping using drugs than by learning how to cope with the stressful situations in their lives that contributed to their becoming addicted [3]. Without

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Figure 1: Saliva-screening device and CopeDiary mobile app.

effective coping skills, abstinence is difficult to maintain because stress and risk can eventually trigger relapses. Cognitive-behavioral therapy (CBT) [3] was developed as an effective method for preventing relapse. CBT is based on the theory that learning to identify high-risk situations and mapping out strategies to deal with such situations can prevent long-term drug dependency.

A main focus of CBT is for addiction therapists to teach drug-dependent patients how to learn effective coping skills. Coping skills refer to mapping out a set of if-then strategies; for example, *if* a particular high-risk situation occurs, *then* (instead of responding with a destructive behavior accompanied by negative thoughts and emotions) a patient can engage in a preplanned constructive behavior accompanied by positive thoughts and emotions. An example of a coping strategy is as follows: If a drug-dependent person becomes involved in a stressful conflict with a family member, instead of feeling angry and consuming drugs to mask the anger, he or she adopts the preplanned safeguarding behavior of calling a supportive friend who can help him or her to release negative emotions and reduce stress.

In outpatient abstinence treatment centers, CBT therapists teach coping skills to drug-dependent patients by first asking them to identify a list of high-risk situations that occur in their lives. It is vital for patients to recognize any destructive behavior and negative thoughts and emotions that arise from such situations. Therapists and patients then discuss and map out safeguarding behaviors to effectively deal with stress and drug cravings. However, given the limited resources at drug rehab clinics in Taiwan, patients may only see therapists once every 2 weeks or less. Communication between drug-dependent patients and

therapists is too infrequent and often limited to face-to-face therapy sessions. Furthermore, prior to therapy sessions, patients may not always complete assigned tasks such as documenting high-risk situations in preparation for an appointment. As a result, patients may not accurately recall high-risk environments, destructive behaviors, and negative thoughts and emotions. Furthermore, coping strategies discussed between therapists and patients may not be properly recorded for quick and easy reference when high-risk situations occur. Such problems create opportunities for developing mobile technologies that can provide feedback from therapists to patients outside of therapy sessions, just-in-time recordings of high-risk situations, and just-in-time lookup of coping strategies for dealing with high-risk situations.

In this study, we designed and built a phone-based support system called CopeDiary to assist drug-dependent patients and therapists in working together to obtain, maintain, and practice coping skills for the patients' daily living environments.

CopeDiary is an extension of our research that explored phone-based systems [13, 14] for self-monitoring alcohol and drug use. Our phone-based support system was inspired by earlier works called CHESS [7] and Computerized CBT [11], which advocated the importance of patients having human professional support when recovering from drug dependency. CopeDiary extends these mobile and digital systems from monitoring alcohol or drug use behavior to skills training (i.e., coping skills) that deals with high-risk situations and can prevent relapse. Other effective treatment options include group counseling and self-help support groups [6, 8] such as Narcotics Anonymous [2], as well as contact with experts and

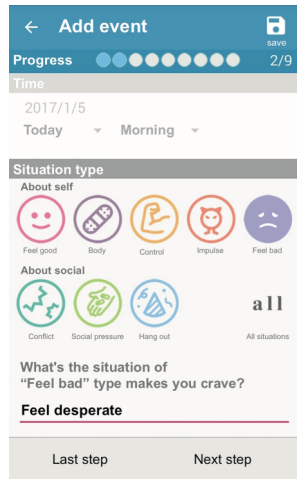


Figure 2: The self-recording function of CopeDiary mobile app.

individuals with similar experiences (for example, through online forums such as Reddit) [4].

The contributions of this study are the design and implementation of CopeDiary, and the findings from a real-world case study of CopeDiary that revealed challenges regarding how to engage drug-dependent patients and their therapists in developing coping skills.

CopeDiary Design and Implementation

CopeDiary comprises a smartphone app, portable Bluetooth-enabled saliva-screening device, and backend server. These components are described in this section.

Saliva-screening device

Figure 1 shows the saliva-screening device that assists patients in collecting their saliva and screens their drug use. Before each test, a patient plugs in a single-use test cassette and spits into a straw in the cassette. The saliva-screening result then appears on the patient's paired smartphone. Our previous paper [13] describes the design and implementation in detail.

CopeDiary mobile app

The CopeDiary mobile app provides three main support functions to enable self-testing for drug use, self-recording of high-risk situations, and ranking and reviewing of high-risk situations. Details of the self-testing function for drug use have been covered in our previous papers [13, 14]. The other two functions are described as follows:

Figure 2 and Figure 3(a) show phone screenshots of the self-recording function, where patients can document high-risk situations that may trigger destructive drug-related behavior, negative thoughts and emotions, and coping strategies for dealing with high-risk situations.

CopeDiary reminds patients to record any high-risk situations immediately after the daily drug test. For example, say a female patient documents a high-risk situation as “having a conflict with my boyfriend” (Figure 3(b)), her drug craving level, which illustrated with skulls, as “high,” destructive behavior as “consuming ketamine drug” because of “anger,” “nervousness,” and “sadness” accompanied by the negative thought, “he wanted to leave me for his ex-girlfriend.” Constructive behavior for coping with such a situation could be to “chat with friends” or “drink” accompanied by the positive thoughts, “there is no need to hurt myself, I am not bad,” so that she can feel “beloved.”

Figure 4(a) shows a phone screenshot for ranking high-risk situations based on frequency of occurrence. This user interface allows patients to quickly review frequently occurring high-risk situations, and provides feedback from a therapist for each situation. Figure 4(b) shows a screenshot displaying coping skills for each situation. Each coping skill has an icon to show its status based on the therapist's feedback as follows:

- *Validated*: this skill has been read and approved by a therapist to be complete.
- *Requires revision*: this skill is incomplete and has not been approved by a therapist.
- *Already discussed*: this skill has been discussed at therapy sessions and recommended by a therapist.

CopeDiary provides a web-based user interface for therapists to offer feedback about coping skills to patients.

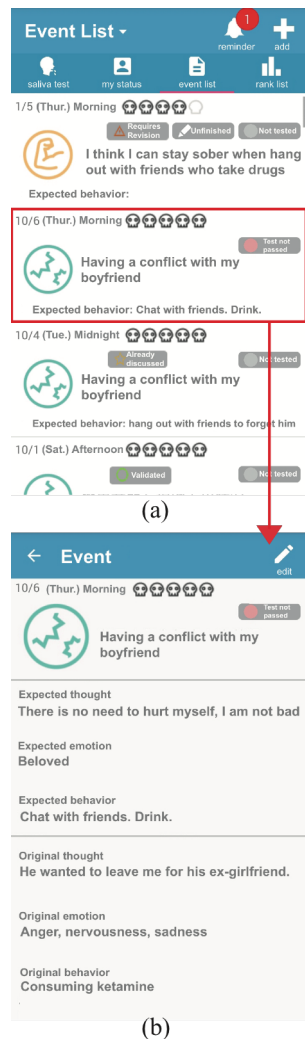


Figure 3: Event list for high-risk situations. (a) Events. (b) Details of an event.

User Study

We conducted a real-life 2-month case study by enrolling three drug-dependent patients who tested CopeDiary to understand how well it assists patients and their therapists in obtaining, maintaining, and practicing coping skills in daily life. This study was approved by the Institutional Review Board of Taipei City Hospital (IRB# TCHIRB-1040411).

Participants

Table 1 shows the profiles of the three participating patients, who were screened by psychiatrists using explicit inclusion and exclusion criteria. All participating patients had to meet the following criteria: (1) DSM-IV criteria of substance abuse disorders [1], (2) consumes ketamine as his or her main drug of choice, and (3) is able to understand and provide informed consent. After explaining the goal of the study, we asked the patients to provide consent and reimbursed them approximately US\$10 for each hospital visit to compensate for travel costs for follow-up assessments. Table 2 shows the profiles of the three participating therapists. Each therapist was reimbursed approximately US\$18 per hourly therapy session. Each patient was provided a portable saliva-screening device paired to a smartphone with the CopeDiary app installed on it.

Procedure

The procedure consisted of the following four parts: (1) pre-study medical assessment, (2) 1-week trial (3) 2-month real-life study with CopeDiary, and (4) post-study interviews. The pre-study medical assessment collected details of baseline ketamine consumption and compliance. To learn how to use the app and screening device, the patients attended a 30-minute training session and a trial over the course of the week following the initial assessment.

We asked the patients to be present at five scheduled medical reviews at the rehab center to answer any questions they had regarding app use. Each patient attended three CBT sessions where the therapists taught them how to learn, implement, and maintain coping skills. We asked the patients to report any problems related to CopeDiary or the screening device. If any patient failed to attend a scheduled medical review, we made a follow-up appointment by telephone. All three patients attended post-study interviews. For each patient, an audio recorder was set up to record a 1-hour semi-structured interview, where we enquired about his or her daily app-related behavior, opinions toward each supporting function of CopeDiary, and notable behavioral changes resulting from using CopeDiary.

Findings

We manually transcribed data retrieved from the audio recordings of regular interviews, post-interviews, and therapy sessions involving the patients and therapists. We coded the transcripts and performed thematic analysis [12] to identify salient themes. The themes focused on engagement with the app, as well as interpersonal concerns that exerted influence on the patients and should be of interest to researchers of human-computer interaction and mental health technology. We organized the emerging themes and findings as follows:

How does CopeDiary help patients to obtain coping skills?

Patient 1 (P1) documented 37 high-risk situations and 37 coping strategies, Patient 2 (P2) documented 38 situations and 35 strategies, and Patient 3 (P3) documented 13 situations and 13 strategies. All three

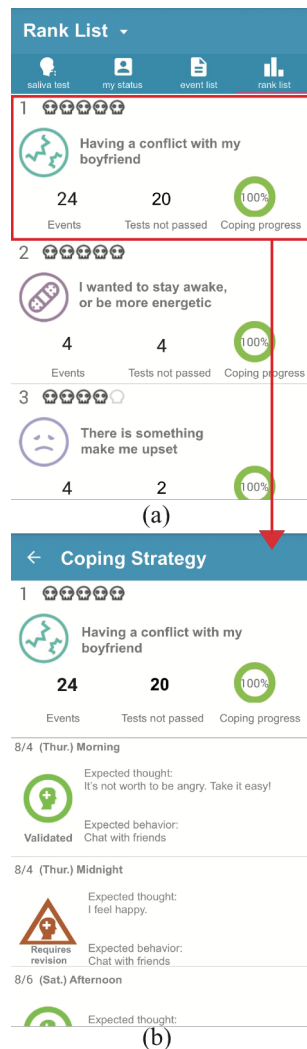


Figure 4: Rank list for high-risk situations. (a) Situations. (b) Coping skills of a situation.

patients commented that CopeDiary was an effective *idea container* where they could store *diverse* coping strategies inspired, learned, or suggested from various sources such as their own ideas and activities, friends, therapists, and psychiatrists. For example, P2's job as a masseuse involved working at night, and thus, staying awake at night. Through frequent app engagement, she was constantly reminded of this challenge and to seek favorable alternatives to drug use. She discovered and recorded the following coping strategy in CopeDiary:

"I wanted to make my mouth fragrant after smoking, so I chewed gum. I found that chewing gum made me feel refreshed, and quickly realized that this was a coping strategy all of a sudden." — (P2)

Medical professionals (e.g., psychiatrists and therapists) are a good source of ideas for collaborative identification of coping strategies. Considering her rough and unpredictable living and work environments, P2's psychiatrist emphasized the importance of not becoming involved in violence. She applied this strategy to the high-risk situation of quarreling with her boyfriend, who would often physically harm her. Rather than feeling trapped and staying silent while tolerating such physical abuse, she recorded the coping strategy of standing up to her boyfriend by telling him not to hit her in CopeDiary.

"The psychiatrist suggested that I ought to stay away from violence, so I told him (her boyfriend) not to hit me." — (P2)

During an interview, P2 referred to another stressful event; that her boyfriend had maintained contact with an ex-girlfriend. When P2 confronted her boyfriend about this, he blamed P2 and her drug problem for causing problems in their relationship. P2's constant

fear of losing her boyfriend was emotional stress that often triggered P2 to seek drugs. When P2 discussed this concern with a friend, her friend suggested her to communicate with her boyfriend directly and clearly. P2 documented this coping strategy in CopeDiary.

"I know it is my fault. He said that he went back to his ex-girlfriend because he had given me many years but I did not change (stop taking drugs). It makes me sad that I cannot help but take drugs." — (P2)

"I have talked with our mutual friends ... They suggested that I explain my condition to him directly and clearly." — (P2)

If therapists have access to what patients record in CopeDiary, CopeDiary can serve as a *device of communication* grounding [10] during face-to-face therapy sessions by building a shared understanding of real recorded high-risk situations, as well as jointly identifying concrete actionable items. For example, therapists can positively enforce desirable coping strategies found in CopeDiary by praising patients and encouraging them to practice the strategies in real life. The following is a conversation recorded during a therapy session between P2 and her therapist. They were discussing P2's boyfriend having maintained contact with his ex-girlfriend. Upon reviewing P2's CopeDiary, the therapist highlighted the coping strategy of "communicate with her boyfriend".

"The most special one is this (points to "communicate with her boyfriend"). Did you figure this out by yourself or hear it from others?" — (T)

"... from my friend. I ought to try to communicate with him." — (P2)

	Gender/Age	Profession
P1	F/30-40	KTV Hostess
P2	F/30-40	Erotic Masseuse
P3	M/20-30	Mechanics

Table 1: Profiles of participating drug patients. (F:Female, M:Male)

	Gender/Age	Years of Experiences
T1	M/30-40	8
T2	F/40-50	11
T3	M/40-50	17

Table 2: Profiles of participating therapists. (F:Female, M:Male)

A therapist may find high-risk situations in a patient's CopeDiary that are lacking appropriate coping strategies. During therapy sessions, therapists can highlight such situations for discussion with a patient to enable the two of them to work together to develop coping strategies.

"If you figured out that how to cope ... is to watch TV dramas or play computer games ... can you think of other possibilities? Are there other activities you could do besides playing computer games or watching TV?" — (T)

"Play Pokémon Go." — (P3)

"You could also try to get a girlfriend, ask friends out for dinner, or ask a girl to watch a movie together. These are different possibilities." — (T)

How does CopeDiary help patients practice coping skills?

After patients record coping strategies in CopeDiary they must put them into practice. By providing easy and quick access to previously recorded coping strategies organized in a simple if-then-plan form, CopeDiary enhances patients' *implementation intention* grounding [9]. When a patient faces a high-risk situation, CopeDiary provides clear instructions on how to respond. During an interview, P2 reflected on how she used CopeDiary to deal with conflicts with her boyfriend that often turned verbally and physically violent.

"I will just open up this (CopeDiary) to see if there are better ways (to cope with this high-risk situation). Of course, I must leave the scene first (just as I recorded in CopeDiary)." — (P2)

The patients reported that some coping strategies did not work well in real-life situations. For example, the

therapists discussed with P2 that she talks to her friends to reduce work-related stress. However, given her work schedule, P2 found that almost all of her friends were asleep when she had free time, and thus were unavailable to talk to her.

"I just think about how pitiful I am ... They (friends) have already gone to sleep when I finish work. ... Although talking to friends and going shopping are both effective ways to reduce stress, I cannot do them (due to time constraints)." — (P2)

Therapists emphasize the importance of patients preparing themselves with *diverse coping strategies* so that they can find behaviors to replace problematic drug behavior. Therapists also emphasize that not all effective replacement behaviors are desirable because patients may replace one destructive or addictive behavior with another. For example, P3 recorded playing computer games as an effective distraction from drug use. When a therapist saw this in P3's CopeDiary, they discussed it during a therapy session:

"I tried quitting drugs but failed ... so I bought a new computer game, and I've kept playing." — (P3)

"Doing more of such things (playing computer games) is not necessarily better. It is also bad to become addicted to computer games." — (T)

P2 recorded drinking and taking sleeping pills as effective coping strategies. After seeing this, a therapist asked P2 about it during a therapy session, and wanted P2 to find another, less destructive substitute.

"Just get myself drunk." — (P2)

"Yes, this is also a method, but is it good? What else have you tried?" — (T)

	Week
P1	1, 3, 4
P2	2, 6, 7
P3	3, 4, 5, 6, 7, 8

Table 3: High-risk situation record disengagement (over half a week of non-use) pattern of the drug patients.

"Taking sleeping pills to help me go to sleep." — (P2)

"What else?" — (T)

Why did the patients disengage from CopeDiary?

All three patients disengaged from CopeDiary at some point during this study as table 3 shows. Two reasons for disengagement were given: (1) The patients expressed a sense of confidence in their current stable lives and abilities to avoid high-risk situations. Hence, they did not feel the need to continue recording and reviewing coping skills. (2) The patients wanted to put drug use behind them. Engaging with CopeDiary might inconveniently remind them of previous drug use. During interviews, they reflected as follows:

"Because there is no quarrel (stress trigger), I do not record (coping skills)." — (P2)

"I do not record or review (coping skills) because there is nothing new (risk situation)." — (P3)

"I do not want to think about drugs; using the app and taking the test will make me think about them." — (P1)

The interviews with the therapists revealed that a sense of confidence and stability in a patient's life was often short-lived. No matter how stable the current situation, unusual circumstances or high-risk situations would eventually catch up with the patient. The therapists offered many examples of patients who, after having not taken drugs for a considerable period, had relapsed because they gradually lost vigilance in coping with high-risk situations.

Interviews between patients and therapists revealed the outcomes of CopeDiary disengagement. Because of neglecting to review coping skills, P1 came to rely mainly on one coping strategy: taking prescribed medication to suppress drug cravings. Medication is

only one dimension of CBT. The long-term goal of CBT is not only to take medication, but also to develop effective and diverse coping skills. A therapist told P1 the following:

"We want more than that (taking medication). There are three dimensions to taking care of ourselves. Physically, we can use medication (to suppress physical cravings). Mentally, we will help you address different problems (high-risk situations). Socially, of course, (we will be productive regarding) family and kids." — (T)

P2 "took a break" from using CopeDiary because she thought that her high-risk situations would not return. However, when they did return, she was unprepared and relapsed to drug use during the study period.

P3 had a caring parent who acted as a watchful guardian to remove risk situations from the patient's life during the study period. Given the absence of high-risk situations, P3 mentioned difficulties in thinking of coping strategies. During an interview, P3's therapist raised the concern that his guardian may not always be available, and questioned P3's coping skills when (new) high-risk situations appeared or returned. Based on experience, P3's therapist was worried that P3 would likely relapse.

Reflection and Recommendation

Reflecting on these findings, we provide the following lessons learned and draw out recommendations on how to design phone-based technology to assist patients and therapists in developing coping skills.

Leverage group/social support

It is essential for patients to learn a diverse range of coping strategies to navigate various high-risk

situations. Determining many different coping strategies is challenging for patients. To address this challenge, CopeDiary can leverage group and social support to become idea sources in coping skills. For examples, P3 did not experience many high-risk situations, because he had a watchful guardian who removed these situations for P3 and often without P3's knowing about them. The guardian could be a vital contributor to CopeDiary by either reminding or identifying high-risk situations for P3. On the other hand, P2 experienced many high-risk situations, but lacked think-outside-the-box ideas. As a result, her friends and therapists could contribute to CopeDiary by suggesting coping ideas to her.

Support two-way communications between patients and therapists

CopeDiary provides only one-way communication where therapists can leave feedbacks on patient's coping skills. However, patients would like to provide feedbacks to therapists on how well these coping skills work in real life, so therapists can better understand each patient's unique situation. For examples, P2 would like to comment on several coping strategies suggested by therapists, e.g., chatting with friends and go shopping, not practicable given her late work schedule.

Prevent app usage lapse

Preventing app usage lapses in patients who may be over-confident about their current stable lives is essential. During the study, all three patients had app usage lapses, and one patient suffered drug relapse due to loss of vigilance. CopeDiary can explore ways to warn and motivate patients about the long-term struggle of drug recovery, as well as the need to maintain continuous app engagement and vigilance.

Ethical considerations

Research on drug patients often involve the collection and analysis of sensitive personal data from vulnerable population. Some of the data may be illegal acts. It is critical to understand the unique ethical challenges, issues, principles [5] in drug epidemiological research.

Conclusion

This paper presents a phone-based support system called CopeDiary that assists patients and therapists in developing coping skills for dealing with high-risk situations in daily life. A 2-month study revealed the following qualitative findings: CopeDiary acted as: (1) an idea container that helped the patients store coping strategies, (2) a communication device that enabled the patients and therapists to focus on discussing the real high-risk situations recorded in CopeDiary, and (3) an enhancer of the patients' implementation intentions by providing easy lookup of simple if-then-plan coping instructions when dealing with high-risk situations. (4) When the patients disengaged from CopeDiary, the therapists warned them of the high probability of drug relapse resulting from the loss of vigilance in high-risk situations and lack of safeguarding coping skills.

This study has a number of limitations. First, we only recruited three patients. Future studies should test CopeDiary using a larger sample size, and include both quantitative and qualitative results. Second, to gain experience in the development of a coping support system, we targeted a schedule III drug (ketamine) [13] with a moderate to low potential for physical and psychological dependency as our initial target drug.

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