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Building an Evidence Base Using Qualitative Data for mHealth Development

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Abstract

To be successful mHealth applications must be consistent with the way individuals use technology. Using qualitative methods and an iterative approach that blends consumer-driven and investigator-driven aims can produce paradigm-shifting, novel intervention applications that maximize the likelihood of use by the target audience and their potential impact on health behaviors. In behavioral health the development of mHealth applications often takes a top-down approach driven by the investigators and programmers, with relatively little input from the targeted population. Often user-input is limited to “like/dislike” post-intervention consumer satisfaction ratings or device/application-specific user analytics. To have a lasting effect on health behaviors it is crucial to obtain user input from the start of each project and throughout development. This paper describes the use of qualitative methods in an end-user participatory framework, and demonstrates how this lead to important changes in our approach to health interventions delivered through mobile technologies.

1. Introduction

Mobile Health or “*mHealth*” is the use of wireless communication devices to send and receive health care, and health related information and data. The emergence of mobile devices, the swift adoption of these devices across the global population [1], and the rapid

expansion of device capability present many challenges for developers of mHealth applications and interventions. One challenge is the complex problem of developing, integrating and adopting mobile communications into existing health care systems. These concerns include device management, privacy & security, data quality, workflow integration, interface design, and resistance to change among healthcare workers [2]. Another set of challenges concerns the structure and content of mHealth interventions themselves. The literature focusing specifically on mHealth interventions has noted that most programs have not used behavioral theory to guide intervention development [3, 4], and relatively few follow evidence-based principles for health behavior change. These deficits are particularly prevalent among applications targeting smoking cessation [5]. Additionally, there is a mismatch between the speed of technology development and our current funding mechanisms and publishing practices that were, for the most part, established prior to the invention of the internet and wireless communications. Using current funding mechanisms and publishing methodology, the results of research on mHealth applications may become available long after the particular device or application has become obsolete. Several solutions have been suggested to improve the speed of funding, testing and intervention modification on a pace more compatible with the advances of mobile and wireless technology [6]. Beyond these issues, another challenge facing mHealth intervention researchers is ensuring that the developed applications and research methodologies are compatible with the ways in which technology is used by the intended audience.

To successfully deliver health interventions and shape new health behaviors, mHealth applications must be designed in a manner consistent with the way that individuals use technology. Using qualitative methods and an iterative approach that blends consumer-driven and investigator-driven aims can result in the development of paradigm-shifting, novel intervention applications that maximize the likelihood that the intervention will be of use, and be used by the target audience – thereby maximizing the potential impact on health behaviors. In public health, behavioral health and related fields, the development and implementation of mHealth applications is often limited to a top-down approach driven by the investigators and programmers, with relatively little input from the population targeted by the intervention. Often, when user-input is requested, it is limited to a “like/dislike” post-intervention consumer satisfaction rating or device/application-specific user analytics such as usability testing of the device and its functionality. However, for mHealth and other technology-based interventions to have a lasting effect on health behaviors, it is not sufficient to develop applications that function as designed and are capable of being used by participants (end-users, the targets of the intervention, aka: “usability”). It is also important, perhaps even crucial, to develop ones that will be stimulating to participants and will actually be used. This process of development requires input from users from the start of the project and throughout development.

In this paper we present a model of mHealth development using qualitative methods in an end-user participatory framework, demonstrating how use of this model led to a paradigm shift in our approach to behavioral health interventions delivered through mobile technologies.

2. Text-2-Quit (T2Q): Changing the Way Tobacco Interventions are Delivered

Each year, smoking kills 443,000 Americans, exacerbates myriad diseases, and costs nearly \$96 billion in health care costs and \$97 billion in productivity losses [7]. Currently, 19% of adults in the U.S. are smokers, a prevalence that has remained unchanged in recent years. Adults under age 35 have the highest smoking prevalence of all age groups (25.3%) [7]. Substantial evidence shows that the majority of smokers (~80%) want to quit, and nearly half (44%) report having made attempts to quit smoking in the previous year [7]. Despite the existence of effective, evidence-based smoking cessation therapies and medications, younger adult smokers are particularly unlikely to seek treatment, compared to older smokers [8, 9]. To effect significant reductions in smoking rates, innovative interventions and treatment delivery systems are needed to reach smokers effectively and efficiently.

Use of mobile phones has saturated the general population, and text messaging is widely used, particularly among younger adults (those under age 35) [10, 11]. Previous research has shown that even brief behavioral interventions for smoking cessation are effective, and conventional telephone counseling has long been preferred by a majority of smokers (>75%) compared to face-to-face treatment programs [12] and is often well received even by unmotivated smokers [13]. Therefore, a logical next step is to adapt smoking interventions for delivery through text messaging. However, there is little theory to support this modality [14], although the existing evidence base is rapidly expanding.

To date, there have been several text message-based interventions designed to aid smoking cessation [15–20]. Rodgers et al. [17] randomized 1705 smokers in New Zealand to receive either a text message based smoking intervention or a control condition. The smoking intervention consisted of five daily text messages for 5 weeks starting the week before their quit day, and 3 messages daily for the remaining 26 weeks of the program. Smoking-related texts focused on content relevant to quitting such as symptoms to expect upon quitting, tips to avoid weight gain, coping with cravings and advice on avoiding smoking triggers. Controls received one text message every two weeks thanking them for enrolling in the study. Significantly more intervention participants (28%) than controls (13%) achieved abstinence. Free et al. [18] randomized 5800 individuals to receive an automated text message program or a control condition. The intervention provided daily text messages (5 times daily for weeks 1–5 then 3 per week through week 26). Text messages provided motivational support, information about quitting smoking and behavior change techniques. Messages also promoted the use of the QUIT smoking cessation telephone helpline and nicotine replacement therapy (NRT). As in the Rodgers et al. study, controls received one text every two weeks thanking them for being in the trial. Abstinence rates at six months were significantly higher among intervention participants (10.7%) than controls (4.9%). Brendryen & Kraft [19] randomized 396 smokers to receive an active smoking cessation intervention or control condition that received only a self-help smoking cessation booklet. The active intervention program involved over 400 contacts across 54 weeks. SMS text messages were a part of the program which also included contacts by e-mail, internet, and interactive voice response (IVR). Both groups were given NRT. At six months significantly more intervention (37.1%) than control (21.6%) participants were smoking abstinent. Whittaker et al. [20] randomized 226 smokers to receive an intervention consisting of text

and video messages delivered to participant's mobile phones or a control program. The intervention was tailored to the participant's selected quit date, role model (for videos), and timing of messages. Messages were delivered daily before quit date, then thrice daily for 4 weeks, then tapering to once every 4 days through week 26. Controls received a general health video message sent to their phone once every two weeks (control). Six-month abstinence rates were high and not significantly different between intervention (26.4%) and control (27.6%) participants. More recently, Haug et al. [21] assessed 755 adolescents and young adults randomly assigned to an active intervention or assessment-only control. The intervention consisted of thrice weekly texts for three months with content tailored based on stage of change for smoking cessation [22]. At the six-month follow up 12.9% of intervention and 9.6% of controls reported 7-day point-prevalence abstinence (7PPA). Of these five studies, three showed significantly greater quit rates among those getting the active text intervention compared with controls. In all five studies quit rates among those given the text message delivered intervention compared favorably against the average cessation rates seen for tobacco cessation quitline counseling (mean 7PPA = 11.1%, rate 8.7–13.4%) [23].

Studies using only text messaging have consistently demonstrated short-term effectiveness, although there is not sufficient data yet to determine effects on long-term smoking cessation rates (i.e., >6 months) [20, 24]. Previous programs were largely adapted from evidence-based smoking cessation treatments, but with little focus on the characteristics that would be optimal for use in a text message delivery system.

The project, nicknamed "Text-2-Quit" (T2Q) was originally conceived as top-down adaptation of a traditional behavioral intervention for smoking cessation that would be delivered through text messages. Core features of behavioral interventions for smoking cessation typically include: (1) education about the addictive nature of tobacco and use of medications to aid cessation, (2) identifying "triggers" such as situations and emotions that cue the individual to smoke, (3) setting a definite future "quit day" (4) problem solving around anticipated difficult situations, (5) enlisting social support, (6) teaching behavioral strategies to break old habits and establish new ones, and (7) one or more face-to-face or telephone (voice) counseling sessions.

The original design for the T2Q intervention included a 2-week program of daily text messages to prepare users for quit day, followed by an 8-week program of text messages beginning with 4 times daily during quit week and tapering to once daily by week 8 post-quit day. The program had different "tracks" to tailor the content, based on the user's smoking status: "Prepare" (preparing for quit day); "Quit" (quit weeks 1–8); "Not Ready" (messages focus on enhancing motivation for making a quit attempt, designed for those not yet ready for the "Prepare" program); and "Prepare-2" (getting ready for a new quit day after a relapse). Messages in the "Prepare-2" track were similar, but not identical to those in the "Prepare" track, to avoid redundancy (and boredom) for individuals who had prepared to quit, relapsed and were now getting ready for a second attempt. The program also allowed users to request additional automated messages to help them deal with immediate cigarette cravings (by texting the keyword "Crave"). We conducted three focus groups to provide

feedback on the planned program content and delivery, so that modifications could be made before conducting the intervention trial.

2.1. Things You Learn When You Ask the Right Questions of the Right People: Formative Research

We used internet advertisements and flyers posted in local commercial venues to recruit participants for focus groups. Individuals calling in response to these ads were screened for eligibility (age 18–35, current smoker or ex-smoker quit less than 1 month, daily user of text messaging). Eligible individuals were invited to attend a single focus group to view a demonstration of the proposed system and provide feedback as potential end-users. Participants ($N=21$, M age=25.6, age range: 20–33) included 18 current smokers (mean cigarettes/day=12.8) and 3 individuals who had recently quit (< 3 months) who used text messaging. All participants completed IRB-approved consent procedures and questionnaires prior to the start of the 2-hour focus group.

For this study we conducted three focus groups. We began with a discussion of computer, social media and other technology use, narrowing to a discussion of mobile phone use. We then gave a short graphical and verbal presentation describing the overall problem of smoking, evidence-based therapies for smoking cessation, and then presented our ideas and planned design for the TXT-2-Quit program. The focus group was then opened for more discussion of the planned program itself, using an *a priori* semi-structured interview guide to promote discussion of the content and functionality of the intervention. Focus groups were audio recorded, then transcribed and coded. The agreed upon coding values and transcripts were entered into NVivo10 qualitative data analysis software.

The major themes that emerged from the focus groups included: support for the acceptability of a text-based cessation program, suggestions for a more technologically broad-based program, and adjustments to the program structure. In particular, participants recommended including social networking functions, more user-control of the program – preferably through an online profile (“*like a Facebook for smokers*”; one participant explained), variability in the timing and delivery of messages, and features that would promote additional interaction with the system. Many participants also stated that the program should be able to start on the user’s quit day, even if that day happened spontaneously with no pre-planning.

In response to focus group feedback the intervention was revised in several ways. First, to enhance user control of the program, we developed additional “key words” that users could text to the program phone number to control their “track” within the program. For example, texting “Slip” increased the number of daily texts to the individual by adding four messages focused on coping with slips and avoiding relapse. Texting “Relapse” would prompt a response asking whether the user was ready to set another quit day (and thus, go into the “Prepare-2” track), or not (and so be assigned to the “Not Ready” motivation-focused track). Second, some focus group participants had indicated that receiving messages at standard times would be helpful: “*Something in the beginning of the day...right in the morning to motivate you.*” But, others said clearly that receiving messages at fixed times would not be useful: “*If I know that I’m getting a text at, let’s say, 9:00 in the morning and 5:00 in the*

afternoon every day, after a while I'm just going to be like 'I'm not even going to answer that, I already know what that's about.'" These suggestions indicated that participants valued the number and frequency of messages, but perceived a need to vary the timing of messages over the course of the program. Therefore, we programmed both a fixed (start of day, end of day) message delivery and variable timed messages.

Finally, many participants wanted to sign up for this program on the day they decided to quit smoking, rather than ahead of quit day. This response contradicted a convention used in most behavioral smoking cessation programs, which are designed around preparing individuals for a specific, future "quit day" that is several days or weeks after program enrollment. Our focus group participants indicated that if they knew of such a program they would probably not sign up for it until they decided that "*today's the day [that I'm quit]*". We adapted to this by prioritizing the content of messages post-quit day to include information users may have missed if they did not go through the Prepare program. We also programmed the system to allow users in any stage of the program to text "Quit" if they decided to quit ahead of their targeted quit day, and immediately begin receiving texts designed for individuals in the first days of quitting.

In addition, an important theme that emerged from the focus groups was participants' strong interest in exchanging messages with others enrolled in the intervention. They perceived this feature as another opportunity to interact with the program and have access to social support from others who were trying to quit at key times: "*If there was like a group, someone like in your group you could text and be like, 'I really need a friggin' cigarette right now.'*" They also wanted immediate support for cravings: "*If there was like one number or something and you text to it, and say like, 'I really want a cigarette,' or whatever, and then get a text message back.'*" We learned that this was consistent with the way they used phones in other situations "*When I try quitting, you know, I'll call my husband...[and say] 'I really want to have a cigarette,' and he'll tell me 'It's not worth it, just, you know, think about what you can get.' So you definitely need someone to interact back with you.'*"

In order to respond to this feedback, we needed to figure out how best to provide individual social support while simultaneously protecting the privacy of program users. Some studies have provided users with contact information for another program user (i.e., a "buddy") upon request. Our experience however, indicated that people are hesitant to ask for special help and to "bother" other individuals whom they don't know. Taking online user groups, in which users can post messages anonymously (using a UserID), as a model, we constructed a separate phone line texting protocol that allowed individuals to text "Help@*" messages that would be sent to 9 other users. We chose to have 10 members for each @*group to maximize the probability that one or more other users would respond while limiting the chances of overwhelming number of responses. For example, an individual who needed support from peers in the program would text a message to "Help@Bluegroup". That message was received and could be responded to by up to 9 other peers enrolled in the program and assigned to the @bluegroup. Conversations in response to such messages functioned much like an online chat. By using this protocol filtered through our central phone line, we protected the actual phone numbers of all participants in the group while providing smoking peer contact.

2.2. Things You Learn when the Rubber Hits the Road: The T2Q Pilot

The Text to Quit (T2Q) study and its procedures were approved by the Institutional Review Board prior to initiating recruitment. The planned recruitment procedures for this randomized controlled trial were as follows: advertisements were placed in local media outlets (internet sites, radio programs) asking interested individuals to call or text our study phone. Our Research Assistant (RA) was to reach callers by voice phone, provide a brief description of the study (pre-screening introduction), and screen callers for study eligibility. Eligible individuals met the following criteria: (1) current daily smoker, (2) interested in quitting smoking in the next 30 days, (3) have a mobile phone with text messaging capability, and (4) use text messaging at least once monthly. Eligible individuals would then be scheduled for an in-person orientation visit during which they would be told more about the program, provide written consent, and take part in a single in-person smoking cessation counseling session. Following initial counseling, participants were to be randomized to either the T2Q intervention or a control condition that received daily motivational (not smoking related) texts.

Over a period of 3 months we received 147 contacts (96 calls, 51 texts). However, we were unable to screen 28 of those who had “text only” phone plans. We were able to contact 83 individuals by voice phone for screening, the vast majority were eligible, but no longer interested when they were told to come for an in-person orientation and counseling session. Altogether, a total of 7 participants were enrolled and randomized using these procedures. These slow recruitment and high attrition rates prompted a change in our recruitment methods: *we needed to implement study procedures that were consistent with the way our target audience used technology*. Traditional methods of in-person orientation, screening and smoking treatment were clearly not acceptable to most of our respondents.

We temporarily put the study on hold for a period of 3 months to develop a web portal that would deliver all recruitment procedures. The initial web page provided the pre-screening introduction to the study. Interested individuals clicked through to a second page that presented an online screener that was programmed to determine the individual’s eligibility. Eligible individuals were then presented with an online consent form to sign electronically. The online consent included a brief quiz to ensure that individuals understood the primary points of the trial: that this was a research trial, that participation was voluntary and could be stopped at any time, and that data were confidential. After indicating consent, the participant provided identifying and contact information, and completed an online baseline assessment. Given the length of these procedures and the limitations of attention-span for online surveys, we allowed participants up to 2 days to return and complete the baseline survey (using their phone number as an identifier). At the conclusion of the assessment, the web program randomly assigned individuals to the two study arms and presented an online Google calendar that participants used to schedule their counseling session. Users also selected whether they wanted to receive their counseling session in person, by voice phone, Skype, or Google Chat. We developed new advertisements that now included the website URL as an option in addition to calling our study phone line. Using these methods, 51 participants were recruited and randomized over the next 21 days. Study results are published elsewhere [25, 26].

2.3. Lessons Learned from TXT-2-Quit

TXT-2-Quit used an iterative mixed-methods approach, meaning that qualitative assessment was an integral, pre-planned part of the intervention/product design. Initial investigator-initiated design was followed by focus groups and the analysis of qualitative data obtained in those groups was used to modify the design. Following this, the program was implemented and both quantitative data (such as recruitment numbers) as well as qualitative feedback (conversations with callers regarding why they were unable to participate) resulted in further changes to the program design. From this process several major themes emerged that had not been identified *a priori*. These included the need for user control of program delivery, need for a peer-to-peer social network for support, and additional features that enhanced user-interaction with the program. From a clinical perspective, the most striking change was the need to develop a smoking cessation intervention protocol that could begin on the individual's quit day. It also became apparent that a marriage of old-style recruitment methods with new technology was doomed to failure. The study was greatly enhanced by revising recruitment and intervention delivery methods to match the way in which technology and mobile devices are normally used by the target audience.

3. Developing an Alcohol Intervention for Community College Students

Excessive alcohol use is the third-leading preventable cause of death in the U.S.[27], and is a widespread problem among college students [28]. Nearly half of all community college students engage in heavy alcohol use [29] which is similar to the high rates seen among students at four-year colleges [28, 30]. However, compared to students at 4-year/residential colleges [31], there has been relatively little effort to assess and intervene with community college students on alcohol related issues, despite these students comprising 40% of all college students nationwide [32]. Epidemiological and observational studies of community college students have reported high levels of alcohol consumption [33], binge drinking [34, 35], and drinking more heavily than students at 4-year/residential colleges [36, 37]. We were unable to locate any papers describing interventions for alcohol use targeted to community college students.

Special efforts are needed for this population since community college (CC) students differ from students at 4-year ("residential") colleges in a number of important ways. CC students are at higher risk for negative consequences of heavy drinking including social and health impairment, physical or sexual assault, and unintentional fatal injuries, and are at significantly higher risk for driving under the influence compared to students at residential colleges [28, 36, 37]. CC students also tend to come from low-income families, have more diverse ethnic/racial backgrounds than students at residential colleges [32], and have multiple roles and responsibilities (e.g., child rearing, single parents, full and part time employment, etc), which speaks to the need for intervention approaches that are tailored to the needs and life-circumstances of this at-risk population. New approaches are needed that reach out to CC students and provide them with harm-reducing interventions. Intervention delivery modalities, particularly mobile health approaches that can be inexpensively provided in an appealing format with wide reach are particularly compelling for reaching this population.

The goal of “Text Message Alcohol Program” (TMAP) is to develop an intervention for alcohol-related harm reduction for CC students delivered using mobile phones and text messaging. The *a priori* design is for a theoretically based intervention whose components include motivational messages, harm reduction strategies, evocative questions, and social networking support.

3.1. Formative Research

Phase 1 of the TMAP project involved program development and evaluation. Community College students, from Rhode Island & Southern Massachusetts age 18–28 years, were recruited to participate in the focus groups. Recruitment strategies included campus media outlets, flyers, email, radio advertisements, and presentations in classrooms. Students were eligible if they met the following criteria: (1) age 18–28 years (2) current CCS (3) reported at least three heavy drinking episodes in the past two weeks (4) have a mobile phone and use text messaging at least weekly. A heavy drinking episode was defined as four or more standard drinks for females and five or more standard drinks for males on one occasion in the past two weeks (a standard drink is a 12 oz beer or wine cooler, a 5 ounce glass of wine, or one mixed drink or 1 shot of liquor). Of the total 40 participants screened, 26 were found to be eligible for the study. The study was approved by the Institutional Review Board at the Rhode Island Hospital and informed consent was obtained from all participants.

Five focus groups were conducted with a total of 26 students (mean age 22.19 years). Each focus group lasted about 2 hours. We were first interested in learning how students used their phones, including if and when they were turned off, when students ignored texts, and if they had either smart phones or text-only services. We next explained our plans for the text-messaging program and showed images of sample text messages that we had written. These sample messages fell into three basic categories: safer drinking strategies, myths and facts about alcohol use, and links to related on-line content. We asked for specific feedback on the content of the texts and for student preferences for message tone (e.g., funny, scary, factual), and format (e.g., text only, texts + links to other information). We also asked what students might text a close friend who was out drinking if they wanted to encourage the friend to be safe about his/her drinking.

As in the T2Q study, focus groups were audio recorded, then transcribed verbatim and de-identified. A detailed codebook was constructed based on *a priori* research questions and emergent content. Two of us individually coded each transcript, then met to review the coding. The agreed upon coding values and transcripts were entered into NVivo10 qualitative data analysis software.

Students helped us identify several themes directly related to drinking wisely, including: finding safe transportation after drinking and ensuring sexual safety. We also heard that messages should apply to some of the many specific drinking contexts, including “pre-game” and “post-game” messages for before and after a drinking occasion, and for purposeful drinking (times when drinking is done specifically to get high or drunk). Messages need to be tailored to the different drinking habits of younger vs. older drinkers, and to those who are less vs. more experienced with alcohol and its effects. Finally, many

students said, in effect: Don't tell me not to drink, or tell me to drink less, but show me you care *how* I drink.

Our participants had different perspectives on the appropriate tone for the texts: some preferred a more "bookish" sounding presentation of facts; others indicated that the messages should sound like they were written by peers. However, most important for the majority was that regardless of the specific content in them, the texts should deliver a message of caring. For example: "*Drink responsibly, someone at home loves you*". Many students specifically said they did not want to receive messages to avoid drinking or to stop drinking altogether. For example, in response to our sample message "Still thirsty? Switch to water. You'll thank yourself tomorrow!" Participants said that (1) they weren't drinking alcohol because they were thirsty and so (2) the message sounded like it was written by people who did not know how or why community college students drink or 3) how they texted. They clearly stated that they were drinking to 'get drunk'. Participants in all the groups indicated that they did not want to be told NOT to drink. But they didn't mind being helped or encouraged to make wise choices when they did drink.

One participant said: "*I think people going out to drink in our age group are like going out specifically to get drunk, so rather than having 'Still thirsty? Switch to water,' like maybe something more serious ... 'don't take out your cars' or like, 'get a ride'.*" Examples of texts written by participants included: "*Hey. You're gonna do what you wanna do no matter what, but do it responsibly,*" and, "*Hey girl, I hope you have fun tonight, but at the same time, be safe. Enjoy your night.*"

Another theme that emerged recurrently was the idea of personalizing the text messages. We had anticipated that participants would prefer messages tailored to their age group and gender. However, participants also suggested that the messages should be personalized based on their alcohol experiences. "*I started like two years ago, as opposed of maybe he started like four years ago... Yeah, like they're more responsible. You get more responsible as you go, I feel.*"

We also recognized that in order to reduce harm associated with alcohol use, the intervention needed to include both fact-based texts to inform and motivate safe drinking AND texts that sounded like they were written by and for community college drinkers. We knew how to write the first category of texts, and we did receive feedback on them during the focus groups. How to craft the second category of texts was informed entirely by the focus groups themselves. During our first group, a participant asked us for a paper and pen, and on the spot, began to (re)write texts in his own words. Motivated by this incident, in all subsequent groups we provided note cards and pens and invited (but did not require) participants to revise our text messages, or to write messages of their own. These messages included: "*How many drinks have you had tonight?*"; "*If you quit drinking tomorrow, you can pay for another semester*", "*Still drinkin'? Switch between soda and water if you wanna stay up and not pass out.*", and "*Don't forget to grab something to eat before you drink*".

As we reviewed these newly written texts, and compared them to our original samples, we began to consider the sociolinguistic implications of the text-based speech from the

perspective of the Columbia University linguist John McWhorter. Although texts are written language, they more closely resemble casual speech which is typically less formal. McWhorter teaches that, in fact, texting is fingered speech; it is a language that has emergent complexity, including its own structure and specific rules [38]. This new linguistic form is developing and evolving, driven by adolescents and emerging adults who are typing speech with their thumbs and then sending it to one another as text. This language is not effectively “spoken” by older adults and behavioral scientists; like most learning a new language, when we write texts we sound like non-native “speakers”.

4. Going Forward

This realization from our qualitative work has led to a redesign of the project procedures. Going forward, we will convene an advisory group of 6–8 individuals from the target population (CC students who drink and use text messaging) to help us construct the actual content of the intervention messages. The advisory group members will be asked to compose texts following themes determined by our investigative team and results from the initial focus groups. They will do this using the appropriate fingered speech, and they will compose them just as a native texter does: on their cell phones.

Having messages written by end-users will enhance the messages’ tone of authenticity. In addition, following the principle of “texting as fingered speech” [38], participants will write texts by directly texting sample messages to our study phone number (our central server). From there the data can be collected, reviewed by investigators and programmed into the text message delivery system.

5. Final Remarks

Results of the T2Q study showed that younger adult smokers were interested in participating in a smoking cessation program that used text messages and web-based elements. However, qualitative feedback from our target audience regarding the perceived optimal features and structure of a technology-based intervention challenged traditional methods of implementing smoking cessation interventions. Similarly, feedback obtained from community college students changed both our approach to alcohol risk reduction intervention, and the manner in which the intervention content will be developed.

We believe it is not sufficient to develop mHealth interventions that function as designed and are usable by individuals in the targeted populations. To have an impact on health and health behaviors, interventions must be perceived by individual users as both useful and desirable. These applications must be something that an individual would *want* to use. To accomplish this, mHealth applications need to be designed such that they are culturally consistent with the way that individuals use technology. In this paper we discussed how using qualitative methods in an end-user participatory framework produced important changes in the delivery and content of two interventions designed to be delivered through text messaging. Using and developing interventions and associated applications, in ways that are consistent with how people use technology, may result in higher perceived utility and desirability of the final application product and ultimately more efficacious interventions.

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