Collecting outcome data of a text messaging smoking cessation intervention with in-program text assessments: How reliable are the results?

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HIGHLIGHTS

- Text messaging interventions have shown promise in helping people quit smoking.
- We examined the consistency of self-reported smoking on two assessment modes.
- We compared self-reported assessments and biochemical verification results.
- Results provide initial support for using text message assessments.

ARTICLE INFO

ABSTRACT

Background: Text messaging interventions have shown promise in helping people quit smoking. Texting programs periodically survey participants about their smoking status. This study examined the consistency of participant self-reported smoking between external surveys and internal program text message assessments.
Methods: Participants in Text2Quit program were surveyed about their past 7-day smoking at one, three, and six months post-enrollment using different survey modes (external surveys and internal program text message assessments) and responses were compared for consistency. The first set of analyses was conducted for participants responding on both modes (n = 45 at one month; n = 50 at three months; n = 42 at six months). Additional analyses, assuming missing = smoking, were conducted with the full sample of 262 smokers (68.7% female, mean age = 35.8 years) and compared to saliva-confirmed abstinence rates.
Results: Participants responding to both modes consistently reported smoking status at one (88.9%), three (88.0%) and six (88.1%) months post-enrollment, with fair to substantial levels of agreement (one month: κ = 0.24; three months: κ = 0.63; six months: κ = 0.66). Participants responding to both modes reported high rates of abstinence. In missing = smoking analyses, significant differences in abstinence rates reported across modes were detected at each timepoint (one month: external = 30.5%, internal = 16.4%; three months: external = 33.2%, internal = 16.0%; six months: external = 31.7%, internal = 12.2%; all p < .001). Moderate levels of agreement were found between the two modes. At 6 months, abstinence rates obtained via internal data were closer to those biochemically verified (15.7%) compared to external surveys.
Conclusions: Results provide initial support for the use of internal program assessments in text messaging programs with missing = smoking assumptions in order to gather outcome data on smoking behavior.

1. Introduction

Given the fast pace of technological change, timely evaluations of technology-based behavior change programs are needed. Over the past several years, a growing body of evidence has accumulated in support of the efficacy of automated text messaging programs for health behavior change including smoking cessation (Free et al., 2013; Whittaker, McRobbie, Bullen, Rodgers, & Gu, 2016; Whittaker, Merry, Dorey, & Maddison, 2012). A recent Cochrane Review of 12 such studies concluded that these mobile intervention double the chances of long-term quitting compared to a control condition (Whittaker et al., 2016). With increasing evidence to support their use, adoption of these

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scalable programs has increased (Abroms, Carroll, Boal, Mendel, & Carpenter, 2016; ITU, 2017; NCD Alliance, 2017).

Typically, evaluations of mHealth programs have relied on data that are collected through a separate survey designed for evaluation (referred to in this paper as "external survey data") through in-person, phone, or web-surveys conducted by the research team, rather than outcomes captured as part of the intervention (referred to as "internal program data") (Abroms, Boal, Simmens, Mendel, & Windsor, 2014; Free et al., 2011; Whittaker et al., 2016; Ybarra, Jiang, Free, Abroms, & Whittaker, 2016). However, the collection of external survey data to track study outcomes and effectiveness is time and resource intensive. Thus, different and scalable methods to assess program outcomes are needed.

One way to achieve timelier and less resource intensive evaluations is to make use of data that are collected as part of a program. Internal program data are generally collected in routine intervention delivery, often to enhance or customize the intervention, and may include surveys that are automated and repeated over time. In some cases, programs may make use of the same (or a very similar) assessment questions as those used in external surveys. Internal program data may offer the advantages of being collected automatically, being significantly cheaper to collect than external surveys, and providing information on a real-time basis (Riley et al., 2011). In fact, some studies are already relying exclusively on internal program data to evaluate mobile apps for smoking cessation (Ubhi, Michie, Kotz, Wong, & West, 2015) and text messaging interventions (Christofferson, Hertzberg, Beckham, Dennis, & Hamlett-Berry, 2016; Cole-Lewis et al., 2016).

In contrast to the potential advantages of using internal program data for evaluation, these data may be subject to a number of limitations, including low response rates and the response bias that may come from participant knowledge that survey data are used to enhance or alter the ongoing intervention. Perhaps most concerning are the low response rates for internal program assessments. In the case of text messaging programs for smoking cessation, previous studies have found response rates for messages to assess abstinence ranging from 34% for the 7-day post quit day assessment to as low as 4% at the 6-month post-treatment assessment in routine intervention delivery (Cole-Lewis et al., 2016). Response rates of between 74% and 62% have been found in clinical trials, with a general pattern of decreasing rates over time (Naughton, Riaz, & Sutton, 2016).

As efforts are underway to roll out text messaging programs in low and middle income countries to address non-communicable diseases such as those caused by tobacco use (ITU, 2017; NCD Alliance, 2017), studies are needed that investigate the effectiveness of these programs. Moreover, as these programs may be adapted and modified over the course of their implementation, studies are needed that investigate their effectiveness on an ongoing basis. In the absence of external survey data, internal program data may prove informative, but studies are needed to investigate the concordance between these assessment modes.

Using data from the Text2Quit study, a RCT of a text messaging program for smoking cessation (Abroms et al., 2014), the current study examines if internal program data, collected via text message, can provide a reliable surrogate for external survey data. Specifically, the study seeks to answer two research questions. 1) What is the concordance in responses of smoking status between those who responded to the external survey and to the internal program text message assessments? 2) What is the concordance in quit rates between the assessment modes when assuming missing = smoking?

2. Methods

2.1. Study procedures and intervention

The study was approved by the George Washington University (GWU) Institutional Review Board (IRB #040810). Recruitment occurred between May 19, 2011 and July 10, 2012. Recruitment and

enrollment took place on the Internet through Google keyword search. Participants who searched Google with keywords related to quitting smoking were displayed study recruitment advertisements in conjunction with their search results. Clicking on ads directed participants to the study website with a screening survey and informed consent procedures. Participants were at least 18 years of age, smoked 5 or more cigarettes a day, had a cell phone number with an unlimited SMS plan, and had an interest in quitting smoking in the next month. This study examines the smoking status of the 262 participants randomized to the intervention group of an RCT of the Text2Quit program. Text messages provided participants with the opportunity to opt out and 30.1% of participants (n = 79) used the keyword STOP to unsubscribe from program texts during the 6-month intervention period. Additional details about the study are reported elsewhere (Abroms et al., 2014).

2.2. Data collection

Data were used from the text messaging program Text2Quit where internal program assessments automatically delivered via text message made use of the same survey question as the external surveys studying the Text2Quit intervention. Text2Quit is a text message-based program, which sends automated, interactive and tailored text messages timed around a subscriber's quit date to aid in smoking cessation. In an external surveys, those randomized to Text2Quit were found at the 6 month follow-up to self-report quitting at higher rates compared to the control group for past 7 day smoking (RR = 1.53, 95% CI = 1.13–2.07, p < .01), (Abroms et al., 2014). As part of the program evaluation, participants received external surveys that assessed, among other items, smoking over the past 7 days. In addition, as part of the Text2Quit program, participants received periodic text message surveys, which assessed past 7-day smoking.

External surveys were predominantly self-administered by study participants through Survey Monkey, but were also done by phone, text, or email where needed. The external surveys were given at 1, 3 and 6-month post-enrollment. Up to 10 attempts were made to remind participants to fill out their external surveys. Participants received a $15 Amazon gift card for each survey completed. The vast majority of participants completed the external survey online (1 month, 91.0%, 3 months, 90.2%; 6 months, 91.1%) with the remaining by phone, text, or e-mail (Abroms et al., 2014).

Program text messages were sent every 7 days in the first month following a participant's quit date and then at 60 days, 90 days, and 6-month after their quit date. After a participant completed the assessment, they received tailored replies (e.g., encouragement and praise, strategies to cope with slips and relapses) and additional help if they indicated that they had smoked. Data of text responses to internal program assessments were recorded on computer servers maintained by the Text2Quit service provider, Voxiva Inc.

2.3. Measures

The primary outcome of interest was self-reported 7-day point prevalence abstinence (Hughes et al., 2003) at 1, 3 and 6-month post-enrollment as reported to external survey ("Have you smoked a cigarette, even a puff, in the last 7 days?") and post-quit date as reported via internal program text message ("Over the past 7 days, have you smoked a cig, even a drag?"). Participants were considered abstinent, if they reported not smoking in the past 7 days. Saliva was collected by mail from participants who reported not smoking in the past 7 days at the 6-month follow-up and cotinine levels of ≤ 15 ng/mL were considered abstinent (65.1% completion rate) (Abroms et al., 2014).

2.4. Sample

To be included in the first analysis (Research Question 1), an individual had to report their smoking status to both external survey and