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Efficacy of a technology-based, integrated smoking cessation and alcohol intervention for smoking cessation in adolescents: Results of a cluster-randomised controlled trial

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ABSTRACT

Objective: To test the efficacy of a technology-based integrated smoking cessation and alcohol intervention versus a smoking cessation only intervention in adolescents.
Methods: This was a two-arm, parallel-group, cluster-randomised controlled trial with assessments at baseline and six months follow-up. Subjects in both groups received tailored mobile phone text messages to support smoking cessation for 3 months, and the option of registering for a program incorporating strategies for smoking cessation centred around a self-defined quit date. Subjects in the integrated intervention group also received tailored feedback regarding their consumption of alcohol and, for binge drinkers, tailored mobile phone text messages encouraging them to maintain their drinking within low-risk limits over a 3-month period. Primary outcome measures were the 7-day point prevalence of smoking abstinence and change in cigarette consumption.
Results: In 360 Swiss vocational and upper secondary school classes, 2127 students who smoked tobacco regularly and owned a mobile phone were invited to participate in the study. Of these, 1471 (69.2%) participated and 6-month follow-up data were obtained for 1116 (75.9%). No significant group differences were observed for any of the primary or secondary outcomes. Moderator analyses revealed beneficial intervention effects concerning 7-day smoking abstinence in participants with higher versus lower alcohol consumption.
Conclusions: Overall, the integrated smoking cessation and alcohol intervention exhibited no advantages over a smoking cessation only intervention, but it might be more effective for the subgroup of adolescent smokers with higher alcohol consumption. Providing a combined smoking cessation and alcohol intervention might be recommended for adolescent smokers with higher-level alcohol consumption.

1. Introduction

Tobacco smoke is a major contributor to the global burden of disease (GBD 2013 Risk Factors Collaborators, 2015). Although the prevalence of tobacco smoking among adolescents in developed countries has been falling over the last two decades, smoking continues to be a serious problem, particularly among those with lower education levels (Inchley et al., 2016; The ESPAD group, 2015). In Switzerland, 29% of male and 21% of female adolescents between the ages of 15 and 19 years smoke cigarettes either daily or occasionally (Gmel, Kuendig, Notari, & Gmel, 2016).

Despite knowledge of several environmental, societal and individual factors, like tobacco control policies, friends and peers smoking, alcohol use, and nicotine dependence, which influence adolescent smoking and smoking cessation (Black & Chung, 2014; Tworek et al., 2010; van Zundert & Engels, 2009; Van Zundert, Kuntsche, & Engels, 2012), evidence on the effectiveness of smoking cessation interventions for adolescents is limited (Stanton & Grimshaw, 2013; Sussman & Sun, 2009). The 2013 Cochrane Review of smoking cessation interventions for those younger than 20 years identified 28 trials, of which only three achieved statistically-significant results (Stanton & Grimshaw, 2013). Although the authors concluded that interventions incorporating elements sensitive to stage of change, motivational enhancement, and cognitive behavioural therapy are promising, they also (1) claimed that there currently was insufficient published empirical evidence for them to support any particular interventional model; and (2) argued for future randomised controlled trials that were both methodologically-robust and sufficiently-powered.

Use of the Internet and mobile phones is extremely popular among adolescents and young adults. For example, in 2016 in Switzerland, 99% and 95% of adolescents ages 12–19 owned a mobile phone and

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used the Internet at least daily, respectively (Waller, Willemse, Genner, Suter, & Süss, 2016). As such, these two media platforms have the potential to provide smoking cessation support to the vast majority of adolescents and young adults. Moreover, mobile phone text messaging opens the door to both individualized and interactive information delivery that is readily accessible everywhere, and irrespective of time. A Cochrane review of 12 studies on primarily text messaging-based smoking cessation interventions revealed a beneficial impact of such interventions on six-month cessation outcomes (Whittaker, McRobbie, Bullen, Rodgers, & Gu, 2016).

A meta-analysis on 14 studies addressing text messaging interventions for adolescent and young adult alcohol or tobacco use (Mason, Ola, Zaharakis, & Zhang, 2015) indicated that effect sizes varied but appeared to cluster in the small to medium range. A recent study from the US (Mason et al., 2016) tested the efficacy of a text messaging smoking cessation intervention to engage urban African-American adolescents through an automated texting program utilizing motivational interviewing-based peer network counselling. At 6-months follow up, participants receiving the intervention significantly decreased the number of days they smoked cigarettes and the number of cigarettes they smoked per day, compared to an attention control intervention.

Another text messaging-based program for smoking cessation that primarily focused on adolescents was tested among vocational school students in Switzerland. This program — named *SMS-COACH* — considered the participants` intention to quit according to the Health Action Process Approach (HAPA) (Schwarzer et al., 2007). During an online assessment, smoking behaviour and attitudes towards smoking cessation were assessed. Thereafter, subjects received one text message every week to evaluate their targeted smoking behaviours for the duration of the three-month intervention. They also received two feedback messages weekly, which were tailored both to their baseline data and their responses to the weekly SMS assessments. Seven-day rates for smoking abstinence at the six-month follow-up evaluation were 12.5% and 9.6% in the intervention and control group, respectively. Though this difference was not statistically-significant, relative to their control-group counterparts, those in the intervention group did experience a significantly-greater reduction in the mean daily number of cigarettes they smoked from baseline to follow-up (Haug, Schaub, Venzin, Meyer, & John, 2013). Despite the promising results of this text messaging-based program, the rate of abstinence from cigarettes did not increase.

One way to potentially enhance smoking cessation rates among those seeking to do so would be to combine smoking cessation and alcohol reduction, for several reasons. First, the vast majority of people who smoke cigarettes also drink alcohol, and adolescent and young adult smokers often engage in hazardous drinking. For example, in one Swiss study assessing vocational school students, 81.3% of smokers, but only 48.5% of non-smokers drank hazardously (Haug, Schaub, Salis Gross, John, & Meyer, 2013).

Second, cravings for cigarettes generally increase during alcohol consumption, as do relapses after successful smoking cessation (Kahler, Spillane, & Metrik, 2010; Sayette, Martin, Wertz, Perrott, & Peters, 2005). This has been confirmed for adolescent smokers (Van Zundert et al., 2012).

A third reason to suggest that integrated program targeting both smoking cessation and alcohol reduction might have merit stems from two different pilot studies involving young adults. In both these studies, which compared an integrated smoking-alcohol intervention and an intervention aiming for smoking reduction alone, the former was associated with clinically-relevant, albeit statistically non-significant superiority in smoking abstinence at final follow-up. In the first of these pilot studies, involving 41 young adult smokers who regularly engaged in binge drinking, tobacco abstinence rates after 12 weeks of treatment were substantially higher (36% vs. 21%) among those in the integrated-intervention group (Ames et al., 2010). In the second, somewhat-larger pilot study involving 95 young adults, corresponding end-of-treatment abstinence rates were 21% and 9% (Ames, Pokorny, Schroeder, Tan, & Werch, 2014).

Hence, the current paper compares the efficacy, in adolescents, of two technology-based programs: (1) an optimized version of the former *SMS-COACH* program, now called *MobileCoach Tobacco* (*MCT*), which targets smoking cessation alone; and (2) an expanded program, called *MobileCoach Tobacco +* (*MCT +*), which integrates smoking cessation and alcohol reduction into one intervention. To our knowledge, ours is the first sufficiently-powered randomised controlled trial (RCT) to compare an integrated intervention targeting both smoking cessation and alcohol reduction, and a smoking cessation only intervention.

2. Materials and methods

2.1. Study objectives and design

This two-arm, parallel-group, cluster-randomised controlled trial, which used school class as the randomisation unit, was designed to evaluate the efficacy of a technology-based integrated smoking cessation and alcohol intervention relative to a smoking cessation only intervention, in terms of inducing adolescents to stop smoking. The study was registered at Current Controlled Trials ISRCTN (ISRCTN02427446, assigned 8 September 2014) and conducted in Switzerland, where participants were recruited between September 2014 and July 2016. The 6-month follow-up assessments were conducted between March 2015 and January 2017, and the study protocol was published on 5 November 2014 (Haug, Paz Castro, et al., 2014).

Our main hypothesis was that the integrated intervention would be more effective than the smoking cessation only intervention at reducing cigarette consumption and achieving smoking abstinence. Secondary outcome measures assessed at the 6-month follow-up evaluation included: (1) 30-day point prevalence of smoking abstinence; (2) stage of change, as per the Health Action Process Approach (HAPA) (Schwarzer, 2008); (3) any attempts to quit over the 6-month observation period; and (4) quantity of alcohol consumption. Furthermore, the study aimed at investigating socio-demographic and health-related moderators of the interventions' efficacy.

The study protocol was approved by the ethics committee of the Faculty of Philosophy at the University of Zurich, Switzerland (date of approval: 13 August 2014), and the trial conducted in compliance with the Declaration of Helsinki. The study was implemented as described in the published study protocol (Haug, Paz Castro, et al., 2014), with the following modification: to adequately consider the nested data structure among students in classes (intra-class correlation for the primary outcome was 13.5% and 3.7–9.5% for secondary outcomes), we performed generalized linear mixed modelling (GLMM; Laird & Ware, 1982) rather than conventional regression models.

2.2. Participants, setting, and procedure

The assessment involved vocational school students, due to the high prevalence of smoking in this population (approximately 42% of one such Swiss sample were daily or occasional tobacco smokers, Haug, Schaub, Salis Gross, et al., 2013). Prevention specialist centres in the Swiss cantons of Zurich, Basel, Berne, Lucerne and Zug invited vocational schools to participate in a study examining the efficacy of a web- and text messaging-based program designed to support smoking cessation. Twenty-four vocational schools, incorporating 360 classes in total, agreed to participate in the study.

Study assistants (Psychology graduate students or employees drawn from the prevention specialist centres) invited all students in the participating classes to take part in an online health survey during a regular school lesson reserved for health education. They also informed students that some of them would be invited to participate further in a study testing the efficacy of an intervention for health promotion. To reduce reporting bias, the study assistants provided no further