# Socioeconomic predictors of smoking cessation in a worldwide online smoking cessation trial

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## ARTICLE INFO

## ABSTRACT

*Objective:* This article studies the impact of country level and individual level socioeconomic factors as predictors of smoking cessation from a worldwide online smoking cessation participant preference study conducted from 2008 to 2011.
*Method:* We collected data through the San Francisco Stop Smoking Internet website. A total of 13,620 adult smokers from 109 countries and territories entered the study. Participants were able to choose from among nine components. Once selected, participants had access to their customized homepage that displayed a navigation bar with only the selected elements. The intervention was designed to take up to 8 weeks to complete. Participants received emails to complete follow-up assessments at 1, 3, 6, and 12 months after enrolling in the study.
*Results:* Of those who provided data at any follow-up (n = 4678), 38.3% reported quitting smoking for at least seven days at one of the follow-ups. Multilevel logistic regression models demonstrated that greater gross domestic product (GDP) per capita, higher level of individual education, and subjective socioeconomic status, significantly predicted the likelihood of quitting at 1-month follow-up.
*Conclusions:* Higher socioeconomic status at country and individual levels are associated with greater success in online smoking interventions. Future studies should address this disparity.

## 1. Introduction

Tobacco-related deaths will soon be responsible for 10% of all deaths worldwide, making smoking the leading cause of preventable death in the world (Mathers and Loncar, 2006). Those losses will be particularly striking among low- and middle-income countries (LMIC) where 80% of smokers reside (World Health Organization, 2014). In response to the growing epidemic, the World Health Organization-sponsored Framework Convention on Tobacco Control (World Health Organization, 2014) calls on parties to develop scientifically based research evidence to assist in tobacco control efforts (Hosseinpoor et al., 2011). Although there is a variety of smoking cessation aids on the market, they are rarely used among LMIC countries' general populations due to their high cost, lack of coverage by public insurance plans, and/or a general mistrust of pharmaceuticals in treating nicotine dependence (Levinson et al., 2006; Levinson et al., 2004; Sansores et al., 2010). It is therefore imperative to explore other viable intervention methods.

Digital health interventions are one potential avenue for the development and wide dissemination of population-based approaches to smoking cessation (Sansores et al., 2010). eHealth approaches, including online interventions, allow for standardized, scalable, low-cost smoking cessation resources that can be used repeatedly throughout the world, without losing their therapeutic power ("non-consumable" -Muñoz, 2010; Muñoz et al., 2014). Our previous studies (Muñoz et al., 2006, 2009) have demonstrated that online interventions yield abstinence rates comparable to those reported for "consumable" interventions (i.e. interventions that are used up when delivered), such as nicotine-replacement therapy or face-to-face counseling (Brendryen et al., 2008; Muñoz, 2010; Schroeder, 2005). eHealth approaches, including online smoking interventions, are therefore a far more realistic

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way of reaching a large amount of smokers including those who cannot afford traditional consumable interventions (Chen et al., 2012). Although, to date, there have been 28 randomized control trials on Internet-based interventions for smoking cessation which have included over 45,000 participants (Civljak et al., 2013), little is known about how socioeconomic factors impact the effectiveness of these interventions.

We have argued that online interventions may help reduce health disparities (Muñoz, 2010), by providing widely available resources to people in countries where such resources are difficult to access or do not exist at all. However, it is unclear whether Internet interventions may preferentially benefit individuals from countries with higher levels of economic development and/or with higher individual socioeconomic standing, thus increasing rather than decreasing health disparities. It is possible that Internet interventions help individuals of higher socioeconomic status or individuals in wealthier countries for reasons other than merely the availability of technology. The goal of this article is to explore, whether country level and individual level socioeconomic factors impact quit rates in an online smoking study, in which all participants could be assumed to have access to the Internet by virtue of their participation in the study. On a country level we examined Gross Domestic Product (GDP) per capita and, on an individual level, education and subjective socioeconomic standing (SSS) (Adler et al., 2000).

Economic factors at both a national and individual level have been linked to smoking behaviors. National income differentially affects rates of smoking behavior across socioeconomic levels, as well as likelihood of attempting to quit and quitting successfully (Schaap and Kunst, 2009; Siahpush et al., 2006). In low and middle-income countries (LMIC), men who belonged to the lowest wealth quintile had 1.36 the odds of smoking compared to those in the highest, whereas both men and women who were more educated were less likely to smoke (Hosseinpoor et al., 2011). One study examining socioeconomic variables in four high-income countries (Australia, Canada, United Kingdom, and the United States) found a distinct disparity between low SES and high SES individuals and their smoking behavior (Reid et al., 2010). Those with lower levels of education and income were less likely to report an intention to quit and were less likely to have quit at a 1-month follow-up, than their higher income and more educated counterparts. In Argentina, men with higher education have lower current smoking rates than those with less education, but for women more education is associated with higher smoking rates (Martinez et al., 2006).

On an individual level, people with low socioeconomic status (SES) tend to have a lower awareness of the negative health effects of smoking (Siahpush et al., 2006), a higher prevalence of smoking (Pampel, 2008), are more likely to be daily smokers and to smoke more cigarettes per day (Hiscock et al., 2012). Consequently, those with lower SES tend to report higher nicotine dependence than people in higher socioeconomic groups (Hiscock et al., 2012; Pennanen et al., 2014). In regards to education, in an LMIC sample, individuals with higher education level have lower odds of smoking than those with lower education (Bosdriesz et al., 2014). Troost et al. (2012) report that higher education level and higher individual income predicts higher likelihood of quitting among persistent smokers, more than country income level, age distribution of smokers, or how recent the onset of smoking began within each country. These findings suggest that individual socioeconomic factors, especially education level, have significant predictive power over whether individuals will become smokers and the likelihood of them successfully quitting.

Another individual level socioeconomic factor that may influence smoking behavior is subjective social status (SSS). Recent studies emphasize that in addition to the relationship between high objective socioeconomic resources and healthy behaviors, such as low smoking rates and high quit rates, the value of socioeconomic resources lies, to a certain extent, in how these resources are perceived (Schnittker and McLeod, 2005; Singh-Manoux et al., 2001). A person's perception of her/his relative position in the social hierarchy, including perceptions

of money, education, and respected jobs is referred to as subjective social status (SSS) (Adler and Matthews, 1994). A growing body of literature documents the association between SSS and health related factors (Demakakos et al., 2008; Ghaed and Gallo, 2007; Nobles et al., 2013). SSS has also been linked to both short- (Reitzel et al., 2010) and long-term smoking abstinence (Reitzel et al., 2011) during a smoking quit attempt. No simple measure of socioeconomic status used in surveys like our study is perfect. The SSS adds a perceived dimension that appears to be complementary to asking only about years of education or income. In studies of two different populations, the SSS predicted health outcomes well and has the potential to go above and beyond traditional SES indicators such as education, income and occupation (Macleod et al., 2005). This may be because SSS transcends access to material goods and resources to capture class standing, tapping into perceptions of social rank and the experience of societal inequalities, all which may have an even more significant relationship to health than traditional measures of SES (Adler et al., 2000 and Franzini and Fernandez-Esquer, 2006).

Taken together, both country and individual level socioeconomic factors are integral in understanding the mechanisms through which smokers quit. Despite their importance, reports based on online smoking cessation studies tend not to focus on socioeconomic factors and focus on a variety of other predictors. For example, high intention to quit and self-efficacy were associated to higher quit rates and more quit attempts (Smit et al., 2014; Elfeddali et al., 2012a; Elfeddali et al., 2012b; Brendryen et al., 2008; Brendryen and Kraft, 2008). The presence of depressive symptoms and history of Major Depressive Episodes was associated with lower quit rates (Muñoz et al., 2012). Regarding gender, results are mixed and controversial for both online smoking cessation studies and face-to-face interventions (Bailey et al., 2011; Hoving et al., 2006; Japuntich et al., 2006; Seidman et al., 2010; Wetter et al., 1999; Woodruff et al., 2008). One socioeconomic factor addressed in online cessation studies is education, which has been associated with an increased likelihood of quitting (Muñoz et al., 2012; Seidman et al., 2010). However, Japuntich et al. (2006) and Hoving et al. (2006) found education had no significant effects on relapse rate. Finally, for marital status, Hoving et al. (2006) found no differences between single and married smokers, but for men who had a smoking partner there was an increased risk of relapse. In two offline longitudinal studies, married men were significantly more likely to quit than those who were not (Broms et al., 2004; Khuder et al., 1999).

To our knowledge, no online smoking cessation studies have reported data on national GDP per capita or SSS. This article examines socioeconomic factors as outcome predictors of a participant preference trial of a stop smoking Internet site (Muñoz et al., 2012) previously tested in traditional RCTs (Muñoz et al., 2006, 2009). Our main interest was to explore the differential effect of country and individual level socioeconomic factors on quit rates in an online smoking cessation trial. At a country level, we examined GDP per capita and on an individual level education and SSS [Ladder] (Adler et al., 2000). Secondary analyses explored predictors previously found to affect quit rates including gender, marital status, and nicotine dependence level.

## 2. Methods

### 2.1. Recruitment

From 1998 to 2011 a team at the University of California, San Francisco, Department of Psychiatry at San Francisco General Hospital conducted several online smoking cessation studies in Spanish and English (Muñoz et al., 2006, 2009; Muñoz et al., 2012, Muñoz et al., 2015). The last study, a participant preference trial of the "San Francisco Stop Smoking Site", ran from 2008 to 2011. Muñoz et al. (2012) presents outcome data from the first year of the participant preference trial. Muñoz et al. (2015) presents outcome data from the subsequent year and a half. The present report is a secondary analysis of the participant preference study data spanning the full two and a half years.