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Causal Effect of Self-esteem on Cigarette Smoking Stages in Adolescents: Coarsened Exact Matching in a Longitudinal Study

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Abstract

Objectives: Identification of the causal impact of self-esteem on smoking stages faces seemingly insurmountable problems in observational data, where self-esteem is not manipulable by the researcher and cannot be assigned randomly. The aim of this study was to find out if weaker self-esteem in adolescence is a risk factor of cigarette smoking in a longitudinal study in Iran.
Methods: In this longitudinal study, 4,853 students (14−18 years) completed a self-administered multiple-choice anonym questionnaire. The students were evaluated twice, 12 months apart. Students were matched based on coarsened exact matching on pretreatment variables, including age, gender, smoking stages at the first wave of study, socioeconomic status, general risk-taking behavior, having a smoker in the family, having a smoker friend, attitude toward smoking, and self-injury, to ensure statistically equivalent comparison groups. Self-esteem was measured using the Rosenberg 10-item questionnaire and were classified using a latent class analysis. After matching, the effect of self-esteem was evaluated using a multinomial logistic model.
Results: In the causal fitted model, for adolescents with weaker self-esteem relative to those with stronger self-esteem, the relative risk for experimenters and regular smokers relative to nonsmokers would be expected to increase by a factor of 2.2 (1.9−2.6) and 2.0 (1.5−2.6), respectively.
Conclusion: Using a causal approach, our study indicates that low self-esteem is consistently associated with progression in cigarette smoking stages.

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1. Introduction

Cigarette smoking is one of the most important public health problems [1], and reviewing the studies in Iranian adolescents, an increasing trend in smoking prevalence in Iranian adolescents can easily be observed [2]. Despite differences in smoking prevalence in different countries, a major concern is that the age of initiating smoking is decreasing in both developed and developing countries [3]. Many of the smokers begin smoking before 18 years of age [4].

A variety of factors such as low conscientiousness, high neuroticism [5,6], and low agreeableness [6], as well as depressiveness [7] have been associated with smoking. Low self-esteem in adolescence predicts vulnerability to depression [8–10], and smoking is a predictor of depression [11]. Low self-esteem in adolescence also relates to a variety of health risk behaviors [12]. Self-esteem has been reported to relate to aspects of adolescent smoking behavior [13,14]. The use of substances is a way to cope with negative feelings and escape from stressors in low self-esteem adolescents [15]. Some studies contradicted these findings, and noted an insignificant association between low self-esteem and the specified risk behaviors [16,17] such as smoking and substances use [18,19].

All in all, smokers often have weaker self-esteem and those with weaker self-esteem are expected to smoke. The majority of studies about the relationship of self-esteem and smoking conducted in adolescents have been cross sectional [20,21] and cohort [22,23] studies. Identification of the causal impact of self-esteem on smoking stages faces seemingly insurmountable problems in observational data, where self-esteem is not manipulable by the researcher and cannot be assigned randomly [24]. Matching and reweighting estimators offer an approach to causal inference using observational data [25].

The perspective toward the concept of self-esteem and smoking might be varied in Iranian adolescents. The disparities in different studies may be due to variations in demographic groups, culture, and definitions of self-esteem [26]. The aim of this study was to find out if weaker self-esteem in adolescence is a risk factor of cigarette smoking using coarsened exact matching (CEM) in a longitudinal study in Iran.

2. Methods

2.1. Participants

In this school-based longitudinal study (with 2 waves during 2010–2012) , a representative sample of 10-grade students of Tabriz (north-west of Iran) were randomly selected by considering the type of school and the number of students in each school. Overall, 196 classes (out of about 865 classes, 82 boys' and 114 girls'

classes) were randomly selected. All 5,106 students of these classes were invited to participate in the study. More details about sampling can be found elsewhere [27]. Finally, 4,853 students (14–18 years) completed a self-administered multiple-choice anonym questionnaire for the first phase of study. One year later, the same questionnaire was distributed to the same students in order to study the changes in their smoking behavior. The participants were ensured about the voluntary nature of participation and confidentiality of information. This study and the related questionnaire were approved by the East Azerbaijan Province Education Organization and Ethics Committee of Tabriz University of Medical Sciences.

2.2. Study tools

We used a standard and valid algorithm for the assessment of smoking stages [28]. Students were classified in three stages of cigarette smoking continuum in the first and second phases of study, according to Mohammadpoorasl et al [19] and Kaplan et al [29], as follows: (1) never smokers: adolescents who have never smoked (even a puff); (2) experimenters: adolescents who have tried cigarettes (even a puff), but have smoked less than 100 cigarettes in their lifetime; and (3) regular smokers: adolescents who have smoked 100 cigarettes and more in their lifetime, without considering their present consumption. Self-esteem was measured using the Rosenberg 10-item questionnaire in the first phase of the study [30]. Each of these 10 questions was assigned a score of 1–4. The answer choices of these questions include "completely agree," "agree," "disagree," and "completely disagree," with the scores assigned to them being 1, 2, 3, and 4, respectively. Attitude toward smoking among the students was measured through six questions similar to those of Hill et al [31]. The general risk taking behavior was measured in a way similar to that of Kaplan et al [29] using the question "Do you enjoy doing a little risky action?", with a "yes" and "no" response. Socioeconomic status of the students was built based on information regarding their father's education, mother's education, family assets, and family income. It was calculated using the principal component analysis. Using this variable, the students were classified into one of the three socioeconomic status levels of high, middle, and lower.

2.3. Data analysis

In this study, we used the CEM method for the estimation of causal effect of self-esteem on smoking behavior of adolescents. The CEM method improves the estimation of causal effects in observational studies by reducing imbalance in covariates between treated and control groups [32,33]. To compensate for the observational data problem where the treated and control groups are not necessarily identical before treatment, matching estimators attempt to control for pretreatment covariates. The CEM model improves the multivariate balance