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The Influence of Peer Behavior as a Function of Social and Cultural Closeness: A Meta-Analysis of Normative Influence on Adolescent Smoking Initiation and Continuation

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Abstract
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Keywords
health risk behavior, peer influence, adolescent, smoking, meta-analysis

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The Influence of Peer Behavior as a Function of Social and Cultural Closeness: A Meta-Analysis of Normative Influence on Adolescent Smoking Initiation and Continuation

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Abstract

Although the influence of peers on adolescent smoking should vary depending on social dynamics, there is a lack of understanding of which elements are most crucial and how this dynamic unfolds for smoking initiation and continuation across areas of the world. The present meta-analysis included 75 studies yielding 237 effect sizes that examined associations between peers' smoking and adolescent smoking initiation and continuation with longitudinal panel designs across 16 countries in the world. Mixed-effects models with robust variance estimates were used to calculate weighted-mean odds ratios. The study showed that having peers who smoked is associated with about twice the odds of adolescents beginning ($\overline{OR}$ = 1.96, 95% CI [1.76, 2.19]) and continuing to smoke ($\overline{OR}$ = 1.78, 95% CI [1.55, 2.05]). Moderator analyses revealed that (a) smoking initiation was more positively correlated with peers' smoking when the interpersonal closeness between adolescents and their peers was higher (versus lower); and (b) both smoking initiation and continuation were more positively correlated with peers' smoking when samples were from collectivistic (versus individualistic) cultures. Thus, both individual as well as population level dynamics play a critical role in the strength of peer influence. Accounting for cultural variables may be especially important given effects on both initiation and continuation. Implications for theory, research, and anti-smoking intervention strategies are discussed.

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The Influence of Peer Behavior as a Function of Social and Cultural Closeness: A Meta-Analysis of Normative Influence on Adolescent Smoking Initiation and Continuation

Despite decades of efforts to reduce tobacco use worldwide, smoking continues to be the leading cause of preventable death and disease in the United States (U.S. Department of Health and Human Services, 2014). Tobacco use killed 100 million people in the last century and will kill one billion in the 21st century if the current trends continue (WHO, 2008). Smoking begins and is established primarily during adolescence, with 90% of adult smokers in the US having begun smoking by age 18. Furthermore, earlier initiation is associated with worse health outcomes later in life (CDC, 2013; Coambs, Li, & Kozlowski, 1992; Pierce & Gilpin, 1995; US Department of Health and Human Services, 2012). Levels of cigarette consumption and nicotine dependence in adulthood are also substantially higher for individuals who initiated and continued smoking during adolescence relative to those who started in adulthood (Breslau & Peterson, 1996; Chassin, Presson, Pitts, & Sherman, 2000). In this context, understanding the predictors of adolescent smoking initiation and continuation is crucial to effectively curb smoking acquisition and escalation and to reduce ultimate negative impacts on health.

Broadly, the actual or perceived behaviors of social referents such as friends (also known as *descriptive peer norms*; Cialdini & Trost, 1998), have received a great deal of attention in studies of adolescent risk behaviors (Bauman & Ennett, 1996; Conrad, Flay, & Hill, 1992; L. A. Fisher & Bauman, 1988; Kobus, 2003; Leventhal & Cleary, 1980; Mcalister, Perry, & Maccoby, 1979; L. Turner, Mermelstein, & Flay, 2004; Tyas & Pederson, 1998). Despite this attention, there is still no precise estimate of the magnitude

of peer influence effects on smoking initiation and continuation, nor understanding of the social and cultural dynamics underlying this influence. Therefore, we first establish the strength of the influence of peer behaviors, as determined by high quality, longitudinal studies. Next, we examine moderating effects of social dynamics at two levels of analysis: closeness of specific peer relationships, and broader cultural influence on the weight placed on interpersonal relationships. Finally, we examine whether these dynamics are equivalent for both smoking initiation and continuation. Do closer peer relationships lead to stronger influence? Do adolescents socialized to value closeness experience greater normative influence leading to smoking? Do friends who smoke pose greater risk in collectivistic regions of the globe, which tend to prioritize group-oriented values? Are these associations different for the behavioral stages of smoking initiation and continuation? Answers to these questions can inform our theoretical understanding of how interpersonal and cultural social dynamics influence behavior during a key period for social development: adolescence. Further, this theoretical understanding has practical implications for potential vulnerabilities to risky behaviors.

Influence of Peer Behaviors across Smoking Stages

Peer behaviors are particularly influential during adolescence. At this stage adolescents start to pursue autonomy and explore their own individual identities by pulling away from their parents and seeking group membership in their own social environment (Brown, Clasen, & Eicher, 1986; Steinberg & Silverberg, 1986). During this stage, adolescents spend more unsupervised time with friends and peers, often at the cost of reducing time spent with parents, and begin to place greater importance on the opinions, acceptance, comfort and advice of peers (Brown, 1990; Fuligni & Eccles, 1993). As a result, adolescents are highly susceptible to peer influence on risk behaviors such as

smoking at this time.

Adolescents may be influenced by the smoking behavior of their peers in different ways, often without being invited to smoke, by simply observing smoking behaviors of salient and valued referents (Akers, 1998; Bandura, 1977, 1985; Steinberg & Monahan, 2007). The more prevalent smoking is among peers, the more desirable and adaptive this behavior appears to the adolescents, and the more likely that they will mimic it (Cialdini, Kallgren, & Reno, 1991; Cialdini & Trost, 1998; Harakeh & Vollebergh, 2012; Rivis & Sheeran, 2003). In addition, peer groups may either intentionally or incidentally impose pressures to conform by providing positive social reinforcement or negative social sanctions on behavioral choices (Kirke, 2004; O'Loughlin, Paradis, Renaud, & Gomez, 1998). Complementing this logic, neuroscience studies have addressed the neural bases of adolescent susceptibility to risky social influence. Such studies suggest that adolescents' greater vulnerability to peer influence, relative to other age groups, is due in part to heightened reactivity within affective and motivational brain systems that can be especially sensitized in the presence of peers. This context-modulated sensitivity may make the social rewards of fitting in and the costs of not fitting in especially salient (Chein et al., 2011; Falk et al., 2014; for reviews, see: Falk, Way, & Jasinska, 2012; Pfeifer & Allen, 2012). In parallel with sheer normative influences, peers may also introduce and teach one another how to smoke, provide access to and opportunities for experimentation (e.g., distributing cigarettes), and bring the adolescent into situations where others are smoking. Indeed, most adolescent smokers report that their smoking initiation occurred with friends and that they obtained their first cigarettes from friends as well (Forster, Wolfson, Murray, Wagenaar, & Claxton, 1996; Presti, Ary, & Lichtenstein,

1992; Yang & Laroche, 2011). After smoking is initiated, adolescents' smoking behaviors may be further maintained or escalated by peer influence and can also reciprocally reinforce their peers' smoking (de Vries, Candel, Engels, & Mercken, 2006).

Previous reviews documenting peer influence on adolescent smoking behaviors have been primarily narrative (Conrad et al., 1992; Hoffman, Sussman, Unger, & Valente, 2006; Kobus, 2003; Leventhal & Cleary, 1980; Mcalister et al., 1979; Simons-Morton & Farhat, 2010; Sussman et al., 1990; Tyas & Pederson, 1998; see exception: Leonardi-Bee, Jere, & Britton, 2011, but focused on parental and sibling influence) and there have been no systematic efforts to quantitatively and conclusively synthesize the large number of studies now available. In addition, although most studies have concluded that peer behavior is a strong predictor of adolescent smoking outcomes, a nontrivial number of studies detected inconsistencies or suggested otherwise. For example, O'Loughlin and colleagues found that compared to those who had no smoker friends at baseline, those who had a few or more smoker friends are more than seven times as likely to transition from a non-daily smoker to a daily smoker at a later time point (O'Loughlin, Karp, Koulis, Paradis, & DiFranza, 2009). However, in another longitudinal study conducted in six European countries, the peer influence paradigm was challenged; the influence of peers' smoking was found significant in only one country. The authors suggested that the homophily in smoking was due to the selection process such that adolescents choose friends with similar smoking behaviors rather than the other way around (de Vries et al., 2006).

Therefore, the primary goal of the present study was to fill this gap by meta-analytically investigating the effects of actual or perceived smoking behaviors among

peers on adolescent smoking behaviors. Prior studies emphasize that adolescents might differ in substance-related cognitions and behaviors depending on the specific stage they are in and the direct experience of substance consumption they might have (Gibbons & Gerrard, 1995; Spijkerman, Eijnden, Overbeek, & Engels, 2007; Stern, Prochaska, Velicer, & Elder, 1987). Therefore, the current study separately examined the effects of peer smoking on adolescent smoking initiation, defined as smoking onset, acquisition, or uptake, and continuation, defined as smoking maintenance or escalation. Specifically, given the evidence that normative influence is usually found to be stronger for adolescents who have no prior direct experience with substance use (Spijkerman et al., 2007), we also examined whether peer behavior exerts greater influence on adolescent smoking initiation compared to their impacts on continuation behaviors.

Furthermore, prior studies have not quantified the magnitude of these effects; therefore, we seek to establish the extent of the association between peer behavior and adolescent smoking initiation and continuation. To do so, we focused on studies with the strongest designs for answering that question. Longitudinal observational studies have two advantages over cross-sectional ones. First, showing simple cross-sectional correlations between peers' and adolescents' own behaviors does not allow scholars to establish clear temporal precedence between the two focal variables, i.e., whether peers influenced adolescents' own behavior or peers were selected on the basis of common behavior. Second, longitudinal studies permit examining how long the influence of peer behaviors might last and whether the magnitude varies depending on when measures are taken.

Social and Cultural Dimensions of Influence: Interpersonal Closeness and

Collectivism Orientation

Although adolescents might generally be sensitive to influence of peer behavior on smoking initiation and continuation, the extent to which they conform to such influence may depend on a range of factors that include both interpersonal dynamics as well as broader cultural influences. Our first hypothesized moderator of the strength of the relationship between normative peer influence and smoking behavior is the *interpersonal closeness* of peers, also referred to as social proximity of normative referents in several social normative theories (Goldstein, Cialdini, & Griskevicius, 2008; Rimal & Real, 2003, 2005; J. C. Turner, 1991). People respond to social pressure differently depending on the subjective importance or value they attach to an interpersonal relationship (Leary & Baumeister, 2000). The interpersonal closeness of different types of peers may affect the ultimate influence of peer crowds, classmates, general friends, and close friends, with closer ties yielding more sizable influences because of long-lasting contact, greater intimacy and emotional attachment, and more time and energy invested in the relationship (Brechwald & Prinstein, 2011; Terry & Hogg, 1999). Other studies have also contended that the quality of the relationship might matter more at the stage of smoking initiation, where mimicry and social conformity tend to play a more decisive role, compared to the stage of smoking continuation where the direct nonsocial experience of smoking comes into play (Flay et al., 1994; Krohn, Skinner, Massey, & Akers, 1985). Therefore, we propose to test whether the interpersonal closeness of peers and relationship quality moderated the association of peer behavior influence with smoking initiation and continuation.

Considering that the social influence of peer behaviors is likely to depend on the

value given to relationships within a community, cultural orientations may play an important moderating role. Culture can work as a mental software that affects our ways of perceiving the world and other people (Bond & Smith, 1996; Chen, 2012; Eisenberg, Fabes, & Spinrad, 2007; Hofstede, 2001; Hofstede, Hofstede, & Minkov, 2010). As a result, the cultural environment in which adolescents develop may influence the degree of peer influence experienced by these adolescents. In particular, the magnitude of social influence should be greater in societies that value interdependent relationships and place group goals ahead of personal goals. In this regard, the collectivism-individualism orientation is a highly relevant culture dimension. Individualistic groups view the self as a unique entity and value independence, whereas collectivistic groups view the self as embedded within a group and give precedence to harmony within groups (Hofstede, 1980; Schwartz, 1990; Triandis, 1995). Findings from cross-cultural studies of social conformity indicate that individualistic societies prioritize personal decisions independent of normative factors, whereas collectivist societies tend to reward conformity more (Bond & Smith, 1996; Bongardt, Reitz, Sandfort, & Deković, 2014; Qiu, Lin, & Leung, 2013; Riemer, Shavitt, Koo, & Markus, 2014; Triandis, 1995).

The Present Meta-Analysis

This meta-analysis quantified the average association between peers' cigarette smoking behavior and adolescents' subsequent cigarette smoking initiation and continuation behaviors, and explored potential sources of effect size heterogeneity. We synthesized studies that used rigorous longitudinal panel designs analyzing whether peers' actual or perceived smoking behavior at an earlier time point (time 1) is associated with adolescents smoking initiation or continuation between time 1 (T1) and time 2 (T2).

We also examined the association between peer behavior and adolescents' subsequent smoking behaviors as a function of the level of interpersonal closeness in peer relationships and national collectivism levels in the diverse countries from which the adolescents were sampled. We used a widely-adopted cultural measure of collectivism, the *Hofstede National Culture Dimension Index*, to characterize the culture of individual countries (de Mooij & Hofstede, 2010, 2011, Hofstede, 1980, 2001; Hofstede et al., 2010; Kirkman, Lowe, & Gibson, 2006; Taras, Kirkman, & Steel, 2010). This collectivism-individualism measure assesses whether individuals perceive themselves as an integral part of a strong cohesive society, make decisions based on context rather than content, and attach higher priority to group preferences (Hofstede & McCrae, 2004). Other conceptually similar measures include *tightness-looseness* (Gelfand et al., 2011) and *GLOBE in-group collectivism practices* (House, Hanges, Javidan, Dorfman, & Gupta, 2004), which also provide comparable national-level culture indices[1]. Potential national-level confounds in the context of adolescent smoking (Forster & Wolfson, 1998; Hamamura, 2012; Warren et al., 2000), including adolescent smoking prevalence, cigarette affordability, level of cigarette advertising regulation, and economic factors were also taken into account. We also supplemented the national culture indices with measures of ethnicity, as previous studies show that people from European origins (whose families originate primarily from the individualistic cultures of the U.S. and Western Europe) are often more individualistic than people from Asian, African American or Latin American backgrounds (Flay et al., 1994; Griesler & Kandel, 1998; Landrine, Richardson, Klonoff, & Flay, 1994; Unger et al., 2001).

Besides the aforementioned theoretical factors, this meta-analysis also explored

methodological and descriptive moderators identified by previous studies as being potentially implicated in the magnitude of the effect sizes. These factors include methodological decisions such as the measures of peer behavior, time (year) of the first-wave data collection, distance between the two waves, the sampling frame, the participant population, whether the effect sizes reported have been adjusted for other covariates, and the numbers of covariates for which the reported effect sizes were adjusted (Hoffman, 2005; Rigsby & McDill, 1972); study characteristics, such as the publication year and type, and the research areas and institutions of the first authors; and sample demographics, such as age, gender, ethnicity, parent smoking status, and parent education level (Ellickson, Perlman, & Klein, 2003; Engels, Vitaro, Blokland, de Kemp, & Scholte, 2004; Hoffman et al., 2006; Hofmann, Asnaani, & Hinton, 2010; Urberg, Degirmencioglu, & Pilgrim, 1997). Among the sample demographic variables, proportions of ethnic groups were also examined to understand the role of ethnic culture difference in the collectivism-individualism dimension on the peer influence – smoking behavior association.

Method

Studies Retrieval and Selection Procedures

To identify eligible studies, we searched electronic databases including ERIC, Embase, Sociological abstracts, Medline, PubMed, PsycARTICLES, PsycINFO, EBSCO Communication Source, ISI Web of Science, and Scopus. The literature search used key words from the following five groups, trying to capture *adolescents*, *peer influence*, *smoking behaviors*, *longitudinal designs*, and exclude studies that are not empirical: (*adolescen** or *youth* or *high school* or *teen** or *child** or *development**) and (*peer* or

*friend** or *social network* or *social group* or *clique* or *norms* or *classmate* or *social influence*) and (*smok** or *cig** or *nicotine* or *tobacco* or *puff**) and *(longitudinal* or *latent growth* or *prospective* or *panel* or *cohort* or *transit** or *progress** or *escalat** or *follow-up* or *lagged* or *subsequent* or *time points* or *time series* or *wave* or *across time* or *over time* or *time 1* or *time one* or *T1*) not (*qualitative* or *focus group* or *book review* or *interview*).[2] We retrieved all studies that satisfied at least one term from each of the five filters in the title or abstract, and were published before September 1st, 2016. Through the database search, we initially identified 7,274 studies. In addition, following the ancestry approach (Johnson, 1993), we also pulled studies from the reference lists of previous narrative reviews on this topic (Conrad et al., 1992; Hoffman et al., 2006; Kobus, 2003; Leventhal & Cleary, 1980; Mcalister et al., 1979; Simons-Morton & Farhat, 2010; Sussman et al., 1990; Tyas & Pederson, 1998), and this process yielded 985 studies. After combing the literature identified by the prior two steps and checking for duplicates, 2,829 studies were included for initial screening. We then read through the titles, abstracts and keywords to remove studies that were obviously unqualified according to our inclusion criteria, and determine the studies that might be potentially eligible for inclusion; 2,569 studies were excluded after this initial screening stage. The rest of the 260 studies were then assessed against the inclusion criteria in detail by further reading the full texts. Our inclusion criteria were as follows:

1. Studies were included if they were empirical observational studies; studies were excluded if they were book reviews, or reports that used exclusively qualitative methods or narrative review (e.g., Parsai, Voisine, Marsiglia, Kulis, & Nieri, 2008), or the sample had undergone any form of experiment or intervention programs (e.g.,

Abroms, Simons-Morton, Haynie, & Chen, 2005).

2. Studies were included if they assessed the association between peer behavior and adolescents' smoking status changes (i.e., initiation and continuation). According to the definitions (Bongardt et al., 2014), studies were excluded if peer behavior was not operationalized as peers' actual or perceived smoking behaviors. Therefore, studies that operationalized peer behavior as 1) peer pressure to smoke, defined as direct and explicit social pressure (e.g., Mazanov & Byrne, 2006), or 2) as peer group membership, which does not directly tap into the presence and prevalence of smoking behaviors within group (e.g., Ludden & Eccles, 2007), or 3) injunctive norm of peer groups, defined as adolescents' perceived approval or disapproval of smoking behaviors from peers without necessarily peers engaging in these behaviors (e.g., Schofffild, Pattison, Hill, & Borland, 2001), were excluded, considering that the influence from these other types of peer norms might take place via very different mechanisms compared to that of the normative influence of peer smoking behavior per se.

3. Studies were included if they assessed longitudinal associations with at least two waves of data collection; cross-sectional studies or the cross-sectional data from larger longitudinal studies were excluded (e.g., Alexander, Piazza, Mekos, & Valente, 2001; Lai et al., 2004; Lambros et al., 2009; Slater, 2003).

4. Studies were included if they reported adequate statistics (i.e., directly provided the index effect sizes [i.e., odds ratios] and standard errors), or reported sufficient information that allowed us to calculate or convert to odds ratios and standard errors (e.g., contingency tables, Pearson correlations, standardized regression coefficients, risk ratios, etc. for effect size calculation; sample sizes, *p*-values and confidence intervals

for standard error calculation); studies were excluded if effect size information or standard errors (e.g., Bogdanovica, Szatkowski, McNeill, Spanopoulos, & Britton, 2015; Morgenstern et al., 2013; Patton et al., 1998) could not be obtained or calculated and was not supplied by authors upon request.[3]

5. Studies were excluded if they measured adolescent smoking behaviors but reported effect sizes for a combination of behaviors, as we would like to distinguish initiation and continuation as two distinct types of behaviors along the continuum of smoking. Thus, we excluded studies that reported effect sizes from combination measures of poly drug use (Pomery et al., 2005), or reported effect sizes that combined both smoking initiation and continuation (e.g., Holliday, Rothwell, & Moore, 2010; McGloin, Sullivan, & Thomas, 2014; Mercken, Snijders, Steglich, Vertiainen, & de Vries, 2010; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012; Morrell, Lapsley, & Halpern-Felsher, 2016).

6. Studies were excluded if the samples' mean age was beyond 10 - 19 years old during the study period, according to the definition of adolescence provided by the World Health Organization (2016)[4] (e.g., Mendel, Berg, Windle, & Windle, 2012).

These procedures led to a sample of 71 studies for inclusion. The above steps are summarized in the PRISMA (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009) flow chart of studies retrieval and selection procedures (Figure 1).

Finally, in an effort to locate more unpublished works in this topic area, we tried three different ways to elicit unpublished effect sizes to be included in our analysis sample: (1) we sent out e-mails to the corresponding authors of the 71 studies that have been identified by literature search as described earlier (and the other authors if the

corresponding author's e-mail address was not deliverable) and asked them whether they had any unpublished works, or if they knew of someone who works in this area and might have relevant unpublished works. If they replied with suggested names, we then followed up with the suggested authors; (2) we posted requests on several listservs of professional associations to elicit unpublished works; [5] (3) we searched for the ProQuest Dissertations and Theses Full-text database, and identified works that both qualify based on our other inclusion criteria and also were not published in any other forms. Through the elicitation process, we were able to obtain additional 15 effect sizes nested within four unpublished studies (i.e., Crossman, 2007; Eaton, 2009; Nonnemaker, 2002; Romer et al., 2008).[6] We then incorporated these unpublished works into our sample for analysis. In total, we obtained 75 studies which yielded 237 effect sizes (184 initiation and 53 continuation) as some studies provided multiple odds ratios or regression coefficients for different sub-groups or different peer behavior measurements. The earliest study included in our sample was published in 1984, and the most recent one was published in July 2016. Tables 1 and 2 present the full lists of the included studies and effect sizes.

Effect Sizes and Data Analysis Considerations

Among the several most commonly used metrics for representing effect sizes, we chose the odds ratio (OR) as the index of effect size in our analysis. Most studies used dichotomous dependent variables, and we converted other forms of effect sizes and standard errors obtained from primary studies into ORs based on effect size transformation formulas (Borenstein, Hedges, Higgins, & Rothstein, 2009; Card, 2012). To facilitate good distributional properties such as normality, we analyzed the natural log transformation of the odds ratio, i.e., $\ln OR$, although we report mean effect sizes in the

original OR metric for ease of interpretation.

As some studies reported multiple effect sizes from the same sample or examined several sub-populations or different behavior transitions (e.g., experimenters to established smokers, or non-daily smokers to daily smokers etc.) within the same study, some of the 237 effect sizes we obtained are not fully independent. Rather, they are nested within the 75 studies. To use all the available effect sizes in our sample without biasing the estimation, we applied the robust variance estimation (RVE) technique proposed by Hedges, Tipton, and Johnson (2010). The RVE approach allows inclusion of dependent effect sizes by correcting the standard errors when the correlations between effect sizes are unknown or could not be estimated (Samson, Ojanen, & Hollo, 2012; Tanner-Smith & Tipton, 2014). Considering that the most prevalent type of statistical dependence occurred in our sample was "hierarchical effects", where a primary study reported different effect sizes from multiple independent samples (e.g., effect sizes reflecting associations between peer smoking and smoking initiation in girls and boys separately), we implemented the hierarchical effects weights in modeling our meta-regressions. This approach moves from traditional weights and variances for each effect size i, $w_i = \frac{1}{SE_i{}^2}$, to $w_{ij} = \frac{1}{(V_j+\tau^2+\omega^2)}$, where V_j is the mean of within-cluster random sampling variance for each cluster j, τ^2 is the estimate of the between-study variance component, and ω^2 is between-study within-cluster variance component (Tanner-Smith & Tipton, 2014). This indicates that to better address the hierarchical nature of effect sizes, three sources of variation are taken into consideration; while V_j represents the random sampling error, τ^2 and ω^2 reflect the degree of heterogeneity from both the between-study and within-study residuals (Hedges et al., 2010; Uttal et al., 2013). We

applied the RVE approach with small-sample corrections (Tipton, 2015) to calculate weighted-mean effect sizes using mixed-effects models which could simultaneously explain variation in effect sizes by estimating the fixed-effects of focal covariates, and account for variation from the three random-effects variance components. We used the I^2 statistic, which quantifies the percentage of non-random variation in the point estimate relative to the total variation, to describe the impact of heterogeneity (Higgins & Thompson, 2002; Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006). In the presence of heterogeneity, we further conducted moderator analyses under the RVE approach. All the analyses were conducted in R with the *robumeta* package (Z. Fisher & Tipton, 2016) to perform hierarchical mixed-effects meta-regressions using RVE approach with small-sample corrections and the *meta* package (Schwarzer, 2014) to perform statistical tests and implement the trim-and-fill method in the evaluation of publication bias.

In addition, a large number of studies (42 out of 75) reported adjusted effect sizes from multiple regressions.[7] This situation is long-standing in the area, and meta-analysts have not yet achieved consensus on a universal approach for dealing with this issue. The ideal scenario would be to synthesize only unadjusted data because with the presence of other covariates, there is usually no way to determine the exact effect between the variables of primary interest. However, using only studies reporting unadjusted effect sizes would have led to great loss of data. Further, there is value in including adjusted effect sizes, which come from more sophisticated analyses designed to represent associations in a realistic, confound-free way (Aloe & Becker, 2011). We thus first explored alternate ways to present the adjusted effect sizes, such as calculating the semi-

partial correlation index proposed by Aloe and Becker (2009, 2011, 2012). This index converts an adjusted effect size into a partial effect size relating the outcome to the unique components of the focal predictor variable, beyond the other predictors in the model. Unfortunately, very few studies in our sample (N = 4) provided the information necessary to calculate the partial effect sizes. Thus, to increase confidence in our conclusions, we conducted moderator analyses to examine whether the two types of effect sizes (i.e., adjusted versus unadjusted) differed. We also classified and coded covariates into four general categories (i.e., demographics, smoking-related covariates, general environmental covariates, and smoking-related environmental covariates), and examined whether the number of covariates in each of the four categories moderated the effects of peer influence.

Moderators

Potential moderators were independently coded by four coders, with each pair of coders having average k = .76 and all ks > .71 between coders used. The disagreements were resolved by coders discussing inconsistencies together.

Theory Based Moderators

Interpersonal closeness of peers. We first coded *interpersonal closeness of peers* into four categories: *general peers, classmates, friends,* and *close friends*. *General peers* was defined as peers of the same age who were not specifically classmates or friends; *classmates* was defined as schoolmates or classmates; *friends* was defined as general friends or peers in the same cliques when the study did not specify close relationships; *close friends* was defined as adolescents' friends with close relationship especially when they were asked to nominate a certain number of best friends and then to

recall their smoking behaviors. Romantic partners and siblings were also categorized as *close friends*. During moderator analyses, we combined the first three categories into *general friends and peers* considering that they all demonstrated similar patterns.

Collectivism. Following prior practices in cross-cultural comparison studies (e.g., Bond & Smith, 1996; Khan & Khan, 2015; Oyserman, Coon, & Kemmelmeier, 2002), we operationalized the concept of culture using nation as a proxy. We first identified the countries where each study was conducted. We then used the Hofstede index (Hofstede, 2001; Hofstede et al., 2010) to assign national collectivism scores for each subsample from which the effect sizes were calculated.[8] Thus, we retrieved scores for each sample using the country comparison tool from the Hofstede Centre (http://geert-hofstede.com/national-culture.html), which range from 0 to 100 with 50 as the midpoint and higher scores representing higher levels of collectivism. To supplement this method, we also obtained two additional indices of culture. Specifically, we retrieved country-level *tightness* scores from Gelfand et al. (2011) and the *GLOBE in-group collectivism practices* scores from House et al. (2004). We also collected information about ethnic group proportions in each sample, and performed moderator analyses with this ethnic culture proxy.

In addition, because considering that national-level collectivism-individualism division may mask a number of other confounded but equally potent influences, we also searched for relevant external country-level statistics, and collected data for the following four factors for each country. Specifically, we recorded the latest tobacco-smoking prevalence in youth (collected from the Global Health Observatory (GHO) data provided by the World Health Organization). Further, we recorded the excise tax for cigarette

purchase (collected from The Tobacco Atlas; Eriksen, Mackay, Schluger, Gomeshtapeh, & Drope, 2015), the level of tobacco advertising regulation (collected from the Tobacco Atlas), and GDP per capita (collected from the World Bank national accounts data; World Bank, 2015).[9] These factors were controlled in the national-level culture moderator analysis in the evaluation of the robustness of the results.

Considering that the two smoking behavioral stages might be qualitatively distinct, and that the importance of the above moderators might vary based on the stages of adolescent substance use engagement (Brechwald & Prinstein, 2011; Maxwell, 2002; Ryan, 2001; Zimmerman & VáSquez, 2011), we first examined whether these theoretical moderators have uniform or different effects across smoking initiation and continuation behaviors, before looking into their moderation effects in the initiation and continuation samples separately.

Methodological Moderators

Peer behavior measurement. We identified the description of how peer behavior was measured in the method section of each study, and coded this variable as a categorical variable with three categories: *smoking or not*, *proportion of peer smoking* (including number of peers smoking), and *amount of cigarettes consumed by peers*.

Year of 1st wave. We recorded the year the study was initially conducted as a continuous variable.

Sampling frame. We identified the description of how the sample was drawn and coded this variable as a categorical variable with four categories: *school students*, *public phone directory*, *other* or *not identified*. The last three categories were later combined into a single category *other* in the moderator analyses due to insufficient sample sizes in

these categories especially in the continuation sample.

Participant population. We identified the description of the participant population in each study and coded this variable as a categorical variable with four categories: *national*, *regional*, *community,* and *school*.

Effect size adjusted by covariates. We recorded effect sizes (ESs) as *adjusted* when they came from multiple regressions controlling for other covariates. When *adjusted* ESs were reported, we recorded the *total number of covariates* and then decomposed the total number into numbers for each of the four following categories: *demographic covariates* (e.g., age, gender), *smoking-related covariates* (e.g., previous experimentation on cigarettes), *general environmental covariates* (e.g., family SES, parent education), and *smoking-related environmental covariates* (e.g., school smoking policy, general smoking prevalence in the local area).

Time distance between two waves. We recorded this as a continuous variable in the unit of months.

Study Descriptive Moderators

Publication type. We recorded the studies as either *unpublished* or *published*.

First author research area. We recorded *first author's research area* as a categorical variable with six categories: *psychology, public health, medicine, communication, sociology, other,* and *not identified*. The last four categories were later grouped into one category *other* in the moderator analyses due to insufficient studies in these categories.

First author institution. We recoded *first author's institution* as a categorical variable with three categories: *university, research center* and *other*. The last two

categories were later grouped into one category *other* in the moderator analyses due to insufficient studies in these categories.

Publication year. We recorded the publication year of the study as a continuous variable.

Age. We recorded the age of the adolescents in the sample. When studies provided a range of ages, we took the mean point of the range.

Gender. For each sample, we recorded the proportion of males as a continuous variable.

Ethnicity. For each sample, we recorded the proportions of participants from *European background, African background, Hispanic background, Asian background* and *other* respectively as continuous variables. This set of ethnic proportions variables not only served as the study descriptive moderators that depict the sample composition in each study, they were also used within each study as a potential culture moderator of peer influence, supplementing our analyses of national culture.

Parent smoking. For each sample, we recorded the proportion of adolescents who had at least one parent who smoked as a continuous variable. If proportions of both mother and father smoking were available, we recorded the higher value.

Parent education. For each sample, we recorded the proportion of adolescents who had at least one parent with at least some college education as a continuous variable. If proportions of both mother and father education were available, we recorded the higher value.

Results

Sample Characteristics

Sample descriptive statistics are presented in Table 3 at the effect size level (k =

184 for initiation and k = 53 for continuation). As shown in Table 3, more effect sizes were obtained from published studies, but our efforts resulted in 6% unpublished effect sizes in total. Among the published studies, most of them were conducted by researchers who work at universities in the area of public health. For initiation (versus continuation) effect sizes, we observed relatively more publications from scholars in the area of psychology compared to those in the continuation effect sizes. A majority of the effect sizes were from studies assessing population effects at the national level. Most of these studies were conducted with adolescent populations in school settings. The average length between the two waves of observations was more than two years for both initiation and continuation effect sizes. Most of the initiation effect sizes we obtained came from multiple regressions controlling for other covariates, while in the continuation sample, the majority of the effect sizes were unadjusted. More than half of the effect sizes in the initiation sample pertained to proportion or number of peers who smoked, whereas most of the effect sizes in the continuation sample were assessed by dichotomous measures of whether peers did or did not smoke. The mean age of the adolescents in both samples was approximately 14-15 years old, and the gender composition was relatively balanced in both samples. Among studies that reported parental smoking status, we found that an average of 46% and 61% of the adolescents reported having at least one parent who smoked in initiation and continuation samples respectively. Further, nearly 60% of the adolescents reported having at least one parent with some college education and above in both samples.

In terms of our theoretical moderators, we observed that first, with respect to social closeness, the smoking behavior of close friends was the most frequently measured

type of peer behavior. In addition, as shown in Table 3, our samples had similar representation of individualistic (8 with collectivism scores below 50) and collectivistic (7 with collectivism scores equal to or above 50) countries, and came from various regions of the world (Africa, East Asia, Europe, Middle East, and North America). The collectivism scores at the country level, therefore, spanned relatively evenly across the Hofstede collectivistic-individualistic continuum. However, the majority of effect sizes retrieved were based on U.S. or European samples, resulting in collectivism being low in average.[10] With respect to the representation of ethnic culture, most of the samples had adolescents from a European background. Table 3 provides summary statistics for all moderators, with details about the two focal theoretical moderators, i.e., interpersonal closeness and the collectivism scores. Tables 1 and 2 present moderator information at the individual effect size level.

Weighted-mean effect Size and Heterogeneity

For the initiation sample (71 studies with 184 effect sizes), the weighted-mean effect size was $\overline{OR}$ = 1.96 (95% confidence interval (CI) [1.76, 2.19]) and was statistically different from zero ($p < .001$). This effect indicates that, for non-smokers at T1, having at least one peer who smoked is associated with about twice greater odds of having initiated smoking by T2. The heterogeneity index was I^2 = 94%, indicating that the effect sizes were more heterogeneous than expected by sampling variability alone. Continuation studies (20 studies with 53 effect sizes) were analyzed in the same way and resulted in similar findings. The weighted-mean effect size was $\overline{OR}$ = 1.78 (95% CI [1.55, 2.05]), and was significantly different from zero ($p < .001$). The non-random variability in relation to the total variability was estimated to be I^2 = 93%. Heterogeneity in both

initiation and continuation samples suggests that there are likely important moderators of the effects observed, and is in support of subsequent moderator analyses to account for the variations.

In addition, as noted earlier, considering that we combined both unadjusted and adjusted effect sizes in the synthesis, to increase confidence in the conclusions, we also examined whether studies with the two types of effect sizes differed. The results indicated that, although studies with adjusted effect sizes on average produced slightly smaller weighted-mean effect sizes, the difference was not statistically significant for either initiation or continuation (initiation: $\overline{OR}_{\text{adjusted}} = 1.90$ versus $\overline{OR}_{\text{unadjusted}} = 2.07$; $p = 0.48$; continuation: $\overline{OR}_{\text{adjusted}} = 1.76$ versus $\overline{OR}_{\text{unadjusted}} = 1.80$; $p = 0.87$). We also confirmed that the number of covariates adjusted in each of the four covariate categories (i.e., demographics, individual smoking-related factors, general environmental factors, and smoking-related environmental factors) was uncorrelated with either initiation or continuation effect sizes (see Table 4 and Table 5 for details).

The average and range of effect sizes for each study (marked with adjusted versus unadjusted), as well as the overall weighted-mean effect sizes are displayed in the forest plots in Figure 2 (Panel A for initiation and Panel B for continuation)[11].

Publication Bias

Despite our efforts to locate unpublished effect sizes in this area as described earlier, publication bias is a potential threat that any systematic reviews and meta-analytic studies might face with (Rothstein, Sutton, & Borenstein, 2006). Therefore, we used multiple methods to assess and quantify the potential impact of the publication bias in the current study. Considering that none of the currently available methods for publication

bias check has been incorporated into robust variance estimation of clustered data, we conducted publication bias checks at both study and effect size levels. For study level examination, we calculated weighted-mean effect sizes for each study (as displayed in Figure 2), and used the 71 (initiation sample) and 20 (continuation sample) statistically independent aggregated study level effect sizes in the publication bias check. For effect-size-level examination, we examined publication bias with all the 184 effect sizes in initiation sample and 53 effect sizes in continuation sample without assuming statistical dependence.

We first built funnel plots (Light & Pillemer, 2009) at both the study level and effect size level for initiation and continuation samples separately (Figure 3A – 3D). If bias is absent, the plot should take a symmetrical triangular shape or a funnel centered on the mean effect size, with studies that have larger standard errors or smaller sample sizes scatter relatively widely at the bottom and narrower spread of those who have smaller standard errors or larger sample sizes (Egger, Smith, Schneider, & Minder, 1997). By visually inspecting the funnel plots, we observed that, for all four figures, even though most of the effect sizes (as indicated by the solid dots on the plots) roughly followed the form of an inverted funnel, the distributions were slightly skewed to the right, indicating an upward bias in the estimated weighted-mean effect sizes. However, such simple visual inspection might be subjective and error-prone, and is considered a less reliable method of estimating publication bias (Terrin, Schmid, & Lau, 2005).

Therefore, we further employed the nonparametric trim-and-fill procedure developed by Duval and Tweedie (2000a, 2000b) to detect and estimate the potential impact of the publication bias in our analyses. The method first estimates how many

studies it would take to achieve the theoretically assumed symmetry in a funnel plot especially when there is absence of studies with small effect sizes on the left side of the plot, and then estimate the weighted-mean effect size again after filling in these potentially missing effect sizes. Researchers should then be able to determine if the extent of bias undermines the interpretation of the study results (Borenstein et al., 2009; Carpenter, 2012; Duval & Tweedie, 2000a, 2000b).

The trim-and-fill procedure estimated that, on the study level, only three studies were filled in for the initiation sample and two for the continuation sample, as demonstrated by the hollow dots on the left part of the plots on Figures 3A and 3B. After including the three potentially missing studies, the weighted-mean effect size for initiation was $\overline{OR}$= 1.84 (95% CI [1.68, 2.01]), which was very close to the estimate obtained based on the original initiation sample with the RVE approach ($\overline{OR}$ = 1.96, 95% CI [1.76, 2.19]). The confidence intervals for the new and original effect size estimates also overlapped with each other and the significance test comparing the original sample and the filled-in sample indicated nonsignificant changes after filling studies with small effect sizes ($t(142) = 0.63$, $p = 0.53$). Similarly, the change between the new study-level estimate ($\overline{OR}$= 1.68, 95% CI [1.45, 1.94]) in the continuation sample and the original estimate ($\overline{OR}$ = 1.78, 95% CI [1.55, 2.05]) calculated based on the original continuation sample with RVE estimation was also trivial ($t(39) = 0.76$, $p = 0.45$). On the effect-size level, the results of trim-and-fill analyses demonstrated that, eighteen effect sizes were assumed to have been produced but gone unpublished in the initiation sample, as shown by the hollow dots on the left side of Figure 3C. With the additional 18 effect sizes, the estimate shrank ($\overline{OR}$ = 1.79, 95% CI [1.63, 1.90]) compared to the original RVE estimate,

although the change was not statistically significant ($t(383) = 1.83$, $p = 0.07$). For continuation studies, after including 15 small effect size studies identified by trim-and-fill procedure, as shown by the hollow dots on the left side of Figure 3D, the weighted-mean effect size did become smaller ($\overline{OR} = 1.58$, 95% CI [1.33, 1.65]), but the confidence intervals still overlapped and the significance test indicated a marginally significant difference ($t(117) = 1.93$, $p = 0.06$). Consequently, there is evidence of some publication bias, especially on the effect size level, but the bias seems to have affected the results minimally.

Moderator Analyses

Theoretical moderators. We then conducted moderator analyses to account for the observed effect size heterogeneity. We first examined whether the interpersonal closeness of normative referents in relation to the target population (i.e., *Close Friends* versus *General Friends and Peers*) might affect the extent to which peer influence takes effects. Considering that smoking initiation and continuation behaviors might be qualitatively distinct behaviors, we also examined whether interpersonal closeness of peers has the same moderation effect across two smoking behaviors. We found that while the main moderation effect was not significant ($\beta = 0.11$, $t(30) = 1.27$, $p = 0.21$), its interaction with behavior type was significant ($\beta = -0.44$, $t(11) = -2.49$, $p = 0.03$). We then further decomposed this interaction effect by examining initiation and continuation samples separately, and summarized the results in Tables 4 (initiation) and 5 (continuation). As can be seen in Table 4, the moderating effect of interpersonal closeness of normative referents was significantly positive in initiation studies such that smoking peers with closer social distance had larger impacts on adolescents' smoking

initiation. Post-hoc comparisons of the *Close Friends* and *General Friends and Peers* categories in initiation studies revealed that the weighted-mean effect size for *Close Friends* is significantly higher compared to that of *General Friends and Peers* ($\overline{OR}_{\text{Close}}$ = 2.20 versus $\overline{OR}_{\text{General}}$ = 1.78; p = .04). However, interpersonal closeness was not a significant moderator in the continuation sample (Table 5).

We then examined the potential moderating effects of national culture, the continuous collectivism scores as defined in the Hofstede index. We first visualized the univariate relation between the collectivism scores and effect sizes, and observed upward positive associations for both initiation (Figure 4A) and continuation (Figure 4B). Moderator analysis further confirmed that collectivism levels significantly and positively moderated the associations between peer behavior and both smoking initiation and continuation behaviors (β = 0.01, $t(13)$ = 2.94, p = 0.01), with no significant interaction with behavior type (continuation vs. initiation; β = 0.00, $t(5)$ = 0.33, p = 0.76). Consistent with our predictions, the impact of peers' smoking was stronger in countries known to have higher collectivism scores. After controlling for potential country-level confounds, including the smoking prevalence in the adolescent population, the affordability of cigarettes, the level of cigarette advertising regulation, and GDP per capita, the patterns still held (β = 0.01, $t(8)$ = 2.99, p = 0.02 combining initiation and continuation samples). Further, there was no significant interaction with behavior type (initiation vs. continuation; β = 0.00, $t(5)$ = 0.03, p = 0.22), which speaks to the robustness of the significant moderation effect of country-level collectivism. We then replicated our analyses of the collectivism scores with the other culture indices of *tightness* and *GLOBE in-group collectivism practices*, combining initiation and continuation samples. Like

collectivism, *tightness* was a significant moderator of peer influence (β = 0.09, $t(7) = 4.15$, $p < .01$), with no significant interaction with behavior type (β = 0.11, $t(2) = 1.83$, p = 0.22). The moderation analysis using the *GLOBE in-group collectivism practices* scores showed the same pattern although it was marginally significant (β = 0.17, $t(4) = 2.42$, p = 0.07). As with collectivism and *tightness*, the *GLOBE in-group collectivism practices* did not interact with behavior type; β = 0.17, $t(3) = 1.34$, $p = 0.27$).

In sum, the consistent patterns of results converge to confirm that, adolescents in societies that are closely knit and prioritize group-oriented values are more likely to be influenced by peer behavior. By contrast, adolescents in more individualist cultures are more self-oriented, and are less likely to initiate and continue to smoke if their peers smoke. This significant and positive moderation effect of collectivism was observed for both smoking initiation and continuation samples (see Tables 4 and 5).

Exploratory moderators. We also conducted exploratory analyses to examine potential moderation effects of methodological factors and study descriptive characteristics. The results are summarized in Tables 4 and 5. For methodological moderators, the measurement of peer behavior significantly moderates in initiation studies, with dichotomous measures (i.e., having peers smoke or nor at T1) yielding larger weighted-mean effect size compared to that of the proportion of peers smoking and amount of cigarette consumption measures (Table 4). Although the same pattern was also observed in the continuation sample (i.e., studies that used dichotomous measures of peer smoking behavior on average produced the largest effect sizes), the difference among effect sizes of different measurement categories was not statistically significant (Table 5). Interestingly, the varying time duration between baseline and follow-up observations did

not show significant moderation for either smoking initiation or continuation, which might serve as an indication of the endurance of peer influence on adolescent smoking behaviors over time.

Moderator analyses on ethnic group proportions (i.e., the "ethnic culture" variable) suggested that, the association between peer behavior and smoking initiation was significantly weaker in samples with higher proportions of adolescents with a European background (p = 0.02; Table 4). The same pattern was also observed in the continuation studies sample, though the moderation effect was marginally significant (p = 0.07; Table 5). The proportions of adolescents with an Asian background was found to significantly moderate the effect of peer behavior on smoking initiation, such that stronger effects were detected in samples with higher proportions of adolescents with an Asian background (p = 0.03; Table 4), and the same pattern also held in the continuation studies though with a marginally significant effect (p = 0.08; Table 5). These findings dovetailed, and to some degree corroborated, the patterns observed in the moderation effects of collectivism levels based on national-level measures described earlier, as populations with a European background have been consistently found to have higher levels of individualistic orientation whereas Asians are considered to be more collectivistic (Bond & Smith, 1996; Triandis, 1993; Vargas & Kemmelmeier, 2013). Published studies on average reported larger effect sizes compared to unpublished studies in both initiation and continuation samples, but such differences were not statistically significant (initiation: $\overline{OR}_{\text{published}}$ = 1.99 versus $\overline{OR}_{\text{unpublished}}$ = 1,67, p = 0.17; continuation: $\overline{OR}_{\text{published}}$ = 1.81 versus $\overline{OR}_{\text{unpublished}}$ = 1.48, p = 0.29). Finally, for both initiation and continuation, adolescents tended to be less affected by peer smoking if their parents did not smoke and

if the education level of either parent was beyond high school. However, these associations were not significant.

Discussion

Adolescence is a transition period during which adolescents start to move away from total emotional dependence on their parents to navigate their independent roles in society. Thus, peers often fulfill needs for social validation and acceptance and are considered the most valued social referents (Fuligni & Eccles, 1993). The influence of peers is so potent that peer behaviors become a major risk factor for smoking initiation and continuation in adolescence. Smoking peers demonstrate tobacco use behaviors that nonsmoker adolescents try to learn and imitate, and intentionally or unintentionally establish a smoking norm that pressures adolescents who do not smoke in addition to increasing the availability of cigarettes. Once smoking begins, socialization and peer selection processes are likely to further reinforce the adolescents' decisions to continue to smoke in the company of their peers.

Understanding and quantifying the effect of peer behavior on adolescent smoking initiation and continuation are essential due to the high burden of smoking on morbidity and mortality and the fact that early initiation is associated with a number of adverse outcomes (e.g., Ellickson, Tucker, & Klein, 2001; Milberger, Biederman, Faraone, Chen, & Jones, 1997; Park, Romer, & Lim, 2013). Most of the reviews in this area, however, have focused on cross-sectional studies and did not distinguish the temporal precedence of the smoking behaviors of the adolescents versus their peers. Furthermore, most existing reviews or syntheses examining effects of peers on smoking behaviors are narrative and come to conclusions based on "vote-counting" (Lipsey & Wilson, 2001). The present study applied a systematic and rigorous meta-analytic method and examined

high quality longitudinal studies of varying duration. In an attempt to more precisely synthesize and quantify the association of peer behavior with smoking initiation and continuation, we also employed the robust variance estimation approach (RVE) with small-sample corrections, a mathematically sound and well-validated method for modeling within-study dependence among effect sizes (Hedges et al., 2010; Samson et al., 2012; Scammacca, Roberts, & Stuebing, 2014; Tanner-Smith & Tipton, 2014; Tipton, 2015). Finally, examining potential moderators of the effect allows us to advance theories of social influence on risk taking during adolescence.

In aggregate, we found significant effects of peer smoking on adolescent smoking initiation and continuation behaviors with appreciable magnitude longitudinally: adolescents were about two times more likely to initiate or continue smoking at a later time if their peers or friends smoked. In addition, we show the important role of peers on both initiation and continuation with longitudinal measures, further validating the theoretical and practical value of this predictor. Indeed, peers appear to have long lasting effect, with the average lengths of time between T1 and T2 in our study being 31 months (*SD* = 28) for initiation studies and 25 months (*SD* = 24) for continuation studies.

We also identified factors moderating the associations between peer behavior and the two types of smoking behaviors. Specifically, interpersonal closeness of peers was a significant moderator for smoking initiation such that smoking onset was more likely when there was a close connection to friends or peers who smoked. Collectivism levels significantly moderated the association between peer behavior and both smoking behaviors, such that the influence of peer smoking on both initiation and continuation was found to be stronger for more collectivistic populations.

Theoretical Implications of Our Findings

The findings from the present synthesis have several implications for theories of normative social influence as well as for campaigns and interventions that make use of normative appeals, especially targeting adolescent populations.

Equally strong influence of peer behavior on smoking initiation and continuation. Previous studies suggested that the importance of peers might differ based on the stages of adolescent substance use engagement. In particular, normative influence was found in several studies targeting different substance use domains to be stronger and more predictive for substance-naïve youths with diminishing impacts as smoking stage advances (Brechwald & Prinstein, 2011; K. M. Jackson et al., 2014; Lloyd-Richardson, Papandonatos, Kazura, Stanton, & Niaura, 2002; Spijkerman et al., 2007; Zimmerman & VáSquez, 2011). Our meta-analysis results suggested otherwise. We found that the point estimate of weighted-mean effect size from the initiation sample ($\overline{OR}$ = 1.96) was relatively larger than that of the continuation sample ($\overline{OR}$ = 1.78), but they were not significantly different from one another (p = .29). These results suggested that peer smoking is strongly and equally associated with adolescents' both subsequent smoking initiation and continuation behaviors, and highlighted the role of descriptive peer norms in guiding behaviors by hinting what might be socially adaptive and serving as a heuristic cue across different stages of smoking (Cialdini, Reno, & Kallgren, 1990; Rimal & Lapinski, 2015). In addition, once smoking begins, the adolescents may spend more time with peers who smoke or have better access to cigarettes, further increasing their likelihood of smoking continuation. At this stage, the smoking behaviors of target adolescents and their peers are likely to mutually reinforce each other.

Interpersonal closeness of normative referents matters for initiation. Our meta-analysis revealed that closer peers tend to produce significantly higher influence compared to more general friends or peers on smoking initiation. This finding aligns with predictions from several social psychological theories supporting the importance of proximal normative reference groups as having greater potential to influence behaviors (e.g., Cialdini & Trost, 1998; Festinger, 1954; Latané, 1981; Rimal & Lapinski, 2015; J. C. Turner, Hogg, Oakes, Reicher, & Wetherell, 1987), and is consistent with findings suggested in previous studies (e.g., Holliday et al., 2010; Simons-Morton & Farhat, 2010). Closer friendships are usually more persistent, involve more values and emotions attached to shared experiences, imply a greater relational investment, promote accuracy of normative perceptions, facilitate exposure to each other's attitudes and behaviors, and thus normative information about smoking is more likely to be internalized in their own value systems (Borsari & Carey, 2003). Together these factors may help to explain the greater impact observed for initiation.

By contrast, interpersonal closeness was not found to be a significant moderator of the association between peer smoking and adolescents' own smoking continuation behavior. One explanation might be that the intimacy or closeness between peers matters more during initiation as a result of increased opportunities to be exposed to the smoking behavior of close peers, and adolescents might be more likely to please their close friends than general peers through conformity. However, after initial engagement, smoking behaviors might be maintained or escalated more by psychological and physiological addiction, relaxation and pleasure during smoking (Krohn et al., 1985), with any visible peer smokers serving to justify and reinforce the legitimacy of the behavior. In other

words, once initiated, smoking by any peers might provide similar smoking cues to induce cravings. Our findings further increase the granularity of the effects of peer behavior by highlighting the different roles of interpersonal closeness of peers played on adolescents smoking initiation and continuation behaviors.

Cultural values influence susceptibility to normative effects for both initiation and continuation. Our study indicated that peer behavior had stronger associations with both smoking initiation and continuation behaviors in more collectivist cultures. The fact that the results based on both "national culture" and "ethnic culture" taxonomies show a consistent pattern helps delineate a more complete picture of the role of collectivism-individualism culture dimension in the peer influence processes. This result demonstrated that the level of collectivism, as a central source of cultural variation in human cognitions and behaviors (Schimmack, Oishi, & Diener, 2005), exercises great influence on the degree to which individuals are sensitive to peer behaviors around them and how much value they attach to social conformity across two smoking behaviors. Individuals from more collectivistic cultures also have more interdependent self-construal, demonstrate stronger identification with normative referents, and thus are more likely to conform to normative influence from their peers. Descriptive peer norms of smoking appear to exert a more powerful impact on behaviors within such populations (Bagozzi, Wong, Abe, & Bergami, 2000; Bond & Smith, 1996; Bongardt et al., 2014; Markus & Kitayama, 1991; Park & Levine, 1999; Qiu et al., 2013; Riemer et al., 2014; Triandis, 1995). These findings also highlight the importance of considering cultural variables in theories of peer influence during adolescence; whereas interpersonal variables did not moderate the relationship between peer behavior and adolescents' risk of smoking

continuation, cultural influence matters.

Practical Implications of Our Findings

Implications for the measurement of peer behavior. Our examination of measurement moderators found that the dichotomous measure of peer behavior (i.e., peers smoke or not) produced significantly larger effect sizes across studies than the proportions measure and the amount of cigarette consumption measure did, which perhaps are more difficult to estimate or recall. This is consistent with Rigsby and McDill's (1972) suggestion that the ability to detect effects as well as to obtain unbiased peer influence estimates might depend on carefully choosing the measures. The measures that asked about the proportions of peers who smoke or specific number of cigarettes consumed by peers might be able to offer more nuance in terms of the dose of exposure in peer smoking (Hoffman, 2005). Such measurements, however, may tap into qualitatively different constructs and also introduce more recall bias and bring in measurement error through a more demanding task (M. O. Jackson, 2013). Complementing the measurement techniques reviewed, a recent growing trend in quantifying the influence of peer behaviors is a social network approach that gathers self-reported and observed behaviors for both the adolescents and their peers. This method permits validation through comparing the perceived and actual behaviors in the peer group, and also provides more extensive network metrics (such as density, centrality, transitivity, etc.) to capture the closeness of relationships as well as the position of the adolescents in their friendship circles (e.g., Bramoullé, Djebbari, & Fortin, 2009; Goldsmith-Pinkham & Imbens, 2013; Leonardi-Bee et al., 2011; Mercken et al., 2010, 2012; Schaefer, Adams, & Haas, 2013; Seo & Huang, 2012).

Implications for anti-smoking campaign or intervention strategies. The results from this meta-analysis also provide insights for the design and implementation of campaigns or interventions aiming to curb smoking initiation and continuation among adolescents. First of all, although campaigns and interventions targeting smoking prevention in adolescents often use normative appeals with general peers as reference groups, our analysis suggests that that referring to close peers may be more efficacious. In addition, our results indicate that the magnitude of peer influence may be moderated by different factors based on the stage of smoking behavior, with different stages requiring different approaches. For example, using socially proximal reference groups in the normative messages may be especially efficacious for campaigns aimed at smoking prevention. Secondly, cultural tailoring may be especially important for developing effective smoking-prevention programs for increasingly culturally diverse adolescent populations. It may be beneficial to consider cultural differences before utilizing descriptive norm messages in an intervention or campaign. For example, campaigns or interventions to prevent smoking initiation or continuation in adolescents from collectivistic cultures may need to apply extra caution to avoid incidentally implying high smoking prevalence among their peers. Avoiding the creation of such descriptive norms in collectivistic groups may also be achieved by emphasizing that high numbers of peers *do not* smoke.

Limitations and Future Directions

There are several limitations to the current meta-analysis that should be acknowledged. First, although it would be ideal to meta-analyze only unadjusted estimates of effect sizes, there are practical barriers to obtaining access to the raw unadjusted data. In our synthesis, despite our efforts to obtain the data directly from

authors, a substantial proportion of qualified studies only had adjusted effect sizes. To reduce information loss, we synthesized unadjusted and adjusted ORs. Moderator analyses comparing adjusted and unadjusted ORs indicated no significant difference between the two types of effect sizes in either our initiation and continuation samples. These results alleviated our concern with limitations in the combination of two types of effects, but future studies should, whenever possible, synthesize unadjusted data or distinguish the contributions of the different covariates.

A second concern in this synthesis is that, although we employed multiple methods to search for unpublished studies and other forms of grey literature, there might still be a potential threat from publication bias. Fortunately, the results of the systematic trim-and-fill procedures at both study and effect size levels, as well as the fact that the published effect sizes were not significantly larger than the unpublished ones, reduced this concern to a great extent such that although we did observe some publication bias in our samples, particularly on the effect size level, such bias affected our results trivially.

Moreover, there are limitations to our analysis of cultural factors. Although it would be ideal to examine the role of culture orientation by having primary measures of collectivism in each study sample, none of the studies in our review included direct collectivism measures. Therefore, following common practice, we relied on national culture as a proxy for individually-assessed cultural values. There are potential threats introduced by this approach. First, national culture is based on politically defined geographic boundaries and may be an imperfect measure of collectivism-individualism (Khan & Khan, 2015; Sheth & Sethi, 1973). Fortunately, the results of using ethnic group as a proxy for ethnic culture generally corroborated our conclusions based on the national

culture proxy. Second, country-level analyses are vulnerable to the ecological fallacy threat (Brewer & Venaik, 2012, 2014; Piantadosi, Byar, & Green, 1988), which denotes invalid projection of national-level data into individual-level data from participants who do not identify with the assumed cultural values for the nation. Third, we acknowledge that the validity of our national culture moderator analysis rests on the validity of an external national culture index. Although the consistent patterns we observed with two other cultural measures increases our confidence in the conclusions based on the Hofstede index, future studies should replicate these analyses with direct measures of cultural orientation. Such replications would also be well served by examining a broader range of countries and conditions that may affect smoking in adolescence.

In the past, cross-cultural comparison studies often involve a single cross-group comparison between samples from two countries (Brewer & Venaik, 2012; Georgas, Vijver, & Berry, 2004; Oyserman et al., 2002; Yang & Laroche, 2011). Against this backdrop, our meta-analytic approach expands the scope of the comparisons and is performed with better controls for country-level factors. In addition, it also reduces the threat of case-category confounds (i.e., when a unique case from a single sample is used to represent the category).

In addition to the points stated above, for future studies, manipulating interpersonal closeness and collectivism level directly may shed further light on the processes underlying the influence of descriptive peer norms as well as provide the ground for more solid causal claims. Moreover, considering that injunctive norms are another type of important normative influence capturing approval for a behavior (Cialdini et al., 1991), it might be a fruitful future direction to explore this type of influence on

adolescent smoking behaviors.

Concluding Remarks

The current study presented the first meta-analysis that systematically synthetized the effects of peer influence, defined as impact of actual or perceived smoking behaviors of peers on adolescents' own smoking initiation and continuation behaviors, using high quality longitudinal research designs. Our results have substantially increased our confidence in the robustness of descriptive norm influence and may serve to inform health communication efforts and policies moving forward. We were also able to identify interpersonal and cultural moderators that offer valuable theoretical and practical implications. We hope that the results from this work will contribute to the development of theories on the impact of descriptive norms at the developmental stage of adolescence, and provide guidelines for anti-smoking campaigns and interventions to leverage peer influence in the direction of health promotion.

References

Note: References marked with an asterisk indicate studies included in the meta-analysis. The in-text citations to studies selected for meta-analysis are not preceded by asterisks.

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Footnotes

[1] To increase our confidence in the conclusions based solely on the Hofstede index (some major critiques of the index: McSweeney, 2002; Schwartz, 1994; Smith, 2002; Smith & Bond, 1998), we identified and applied two other similar national-level collectivism culture value indices in our analysis to examine whether similar or different patterns would emerge. First, the tightness-looseness framework proposed by Gelfand et al. (2011) based on a 33-nation study is conceptually parallel to the Hofstede collectivism-individualism dimension. According to Gelfand et al. (2011), countries with high tightness scores have strong norms and a low tolerance of deviance from conforming to the norms. Therefore, peer influence in tight nations may have greater impacts. Second, the GLOBE index (House et al., 2004) is a widely used cross-cultural comparison framework based on studies of 62 countries, and has been applied by researchers in ways very similar to that of the Hofstede scores over many years. Specifically, the GLOBE model distinguishes two dimensions of collectivism, i.e., institutional collectivism versus in-group collectivism, and is measured with two forms of questions, i.e., practices ("as is"; reflecting current practices) versus values ("should be"; reflecting future expectations). In the current study, we retrieved the scores of the in-group collectivism practices dimension, which are conceptually more similar to the Hofstede collectivism, and align better with the goals of the current study.

[2] The * was used as a wildcard here such that the search terms can include more variations of a single word or phrase. For example, adolescen* could exhaust the search for any word that containing the part before the asterisk, such as adolescence, adolescent, adolescents, and so on.

[3] We have sent e-mails to the corresponding authors (other authors too if the corresponding author's e-mail address reported was not deliverable) of the studies that we need more information to perform analysis. For example, Ayatollahi, Rajaeifard, and Mohammadpoorasl (2005) satisfied all the other inclusion criteria. However, based on the information provided in the paper, we could not convert F-statistics into odds ratios, which is the uniform effect size form based on which we calculated the weighted-mean effect size. We then sent e-mails to the authors, and they kindly provided the relevant information we need for calculation, thus we were able to include the effect size from this study in our sample for analysis. There were also very few cases where the study qualifies for inclusion by other criteria, however, the e-mail sent was either not deliverable or getting no response or the authors could not extract the information we need due to the long period of time since the study was originally conducted. Thus those few studies (n = 3), were not included in our sample.

[4] We did include though, two effect sizes that were calculated based on the sample whose mean age was 9 at time 1 from C. Jackson (1998) and Milton et al. (2004), considering that the adolescents were between 10-19 years old at time 2.

[5] The listservs of professional associations we have posted on were: Social Psychology Network, Society of Behavioral Medicine, Society for Personality and Social Psychology, European Health Psychology, American Academy of Health Psychology, Society for Consumer Psychology, and Society for Experimental Social Psychology.

[6] We would like to extend special thanks to Dr. Daniel Romer, who kindly provided us with their unpublished datasets for calculation of effect sizes.

[7] For the studies that reported only adjusted odds ratios in our analyses sample, we contacted the corresponding authors (and the other authors if the corresponding author's e-mail address was not deliverable) to request for unadjusted values. We have incorporated unadjusted odds ratios provided by Drs. Ciska Hoving, Hein de Vries, Liesbeth Mercken, and Asghar Mohammadpoorasl. We are grateful for the kind help from these authors.

[8] The Hofstede Centre webpage originally provided the individualism scores. For ease of interpretation, we reverse coded this cultural dimension to be collectivism by subtracting the individualism scores from 100.

[9] The latest youth current tobacco smoking prevalence for each country was collected from the Global Health Observatory (GHO) data as compiled by the World Health Organization and partners in close consultation with Member States using standard measures across countries and was accessed through http://www.who.int/gho/countries/en/. Country-level excise tax for cigarette purchase and levels of tobacco advertising regulation (conceptualized as the percentage of bans enforced out of 14 types of possible bans on advertising in each country) were obtained with the Tobacco Atlas' online resources http://www.tobaccoatlas.org/topic/taxes/ and http://www.tobaccoatlas.org/topic/regulations/ respectively. The GDP per capita data was accessed through the online World Bank national accounts data, and OECD national accounts data files http://data.worldbank.org/indicator/NY.GDP.PCAP.CD. Due to the limited space, the values we collected for the four variables were not included in the current manuscript, but will be available upon request.

[10] Collectivism here refer to the Hofstede collectivism scores. The descriptive statistics of the *tightness* and *GLOBE in-group collectivism practices* scores are summarized in Table 3 and the detailed information of the two indices corresponding to each individual effect size is presented in Tables 1 and 2. Considering that the two indices serve to supplement the results based on the Hofstede collectivism scores, and due to the limited space, description of the two indices is not as detailed as that of the Hofstede collectivism scores in the text and in Table 3. Moderator analyses using the two indices show similar patterns of moderation effects in the overall dataset (initiation and continuation samples combined), thus separate moderator analyses for initiation and continuation samples respectively were only conducted using the Hofstede collectivism scores, which have way fewer missing values compared to the two other indices.

[11] The forest plot summarized effect sizes at study level (N = 75). We also displayed all effect sizes from included studies (N = 237) with detailed corresponding moderator levels in Table 1 (initiation studies) and Table 2 (continuation studies).

Table 1

Effect Sizes and Moderator Values (Levels) in Initiation Studies Sample

	ES	N	Interpersonal Closeness	Country/ Region	COLTightness		GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Ayatollahi et al. (2005)	0.26	912	Close	Iran	59			Prop/Num	PUBH	UNIV	15.95	100							Phone	Regional	2003	8
Bauman et al. (2001)																						
Age 13	1.26	936	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	13						58		Student	National	1994	36
Age 14	0.39	738	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	14						61		Student	National	1994	36
Age 15	0.66	666	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15						58		Student	National	1994	36
Age 16	0.40	630	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	16						59		Student	National	1994	36
Age 17	0.97	662	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	17						52		Student	National	1994	36
Male	0.58	1712	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	100					60		Student	National	1994	12
Female	0.78	1920	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	0					56		Student	National	1994	12
White	0.84	2278	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		100	0	0	0	61		Student	National	1994	12
Black	0.24	893	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	100	0	0	52		Student	National	1994	12
Hispanic	0.58	461	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	0	100	0	53		Student	National	1994	12
Bernat et al. (2008)																						
Friends, non-smoker vs. triers	0.52	2582	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Friends, non-smoker vs. occasional users	0.98	2328	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Friends, non-smoker vs. early onset	1.24	2219	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Friends, non-smoker vs. late onset	0.76	2255	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Peers, non-smoker vs. triers	0.28	2582	Peers	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Peers, non-smoker vs. occasional users	0.66	2328	Peers	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Peers, non-smoker vs. early onset	0.75	2219	Peers	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Peers, non-smoker vs. late onset	0.46	2255	Peers	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14	41	85						Phone	Community	2000	12
Bidstrup et al. (2009)																						
1st follow up	1.92	847	Close	Denmark	26		3.6	Dichotomous	MED	Center	13	47	100	0	0	0			Student	National	2004	6
2nd follow up	0.79	411	Close	Denmark	26		3.6	Dichotomous	MED	Center	13	47	100	0	0	0			Student	National	2004	18
Blitstein et al. (2003)																						
Close friends	0.34	647	Close	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	13.9	40		75			29		Student	School	1995	24
Peers	0.07	645	Peers	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	13.9	40		75			29		Student	School	1995	24
Bricker et al. (2006)	0.58	4744	Close	USA	9	5.1	4.2	Dichotomous	PUBH	Center	13	51	91				44		Student	Regional	1984	108
Chang et al. (2006)																						
Close friends	1.77	1511	Close	Taiwan	83		4.3	Dichotomous	PUBH	UNIV	15.5	54	0	0	0	100	54		Student	School	2001	24
Peers	1.79	1511	Friends	Taiwan	83		4.3	Prop/Num	PUBH	UNIV	15.5	54	0	0	0	100	54		Student	School	2001	24
Chen & Jacques-Tiura (2014)																						
female: pre-teen initiation vs. low-risk group (nonsmoker)	1.35	788	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	0	63						NA	National	1997	132
female: teenage initiation vs. low-risk group (nonsmoker)	0.92	1511	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	0	70						NA	National	1997	132
female: young adult initiation vs. low-risk group (nonsmoker)	0.18	962	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	0	62						NA	National	1997	132
male: pre-teen initiation vs. low-risk group (nonsmoker)	1.21	777	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	100	77						NA	National	1997	132
male: teenage initiation vs. low-risk group (nonsmoker)	0.88	1221	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	100	76						NA	National	1997	132
male: young adult initiation vs. low-risk group (nonsmoker)	0.25	1017	Classmates	USA	9	5.1	4.2	Dichotomous	MED	UNIV	14.7	100	71						NA	National	1997	132
Chun et al. (2013)																						
Male	0.84	1594	Close	South Korea	82	10	5.7	Dichotomous	SOCI	UNIV	14.8	100	0	0	0	100			Student	School	2004	36

	ES	N	Interpersonal Closeness	Country/ Region	COL	Tightness	GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Female	1.43	1594	Close	South Korea	82	10	5.7	Dichotomous	SOCI	UNIV	14.8	0	0	0	0	100			Student	School	2004	36
Cowdery et al. (1997)																						
Male, close male friends	1.65	192	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	17.6	100	0	0	100	0			Phone	National	1989	36
Male, close female friends	2.39	192	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	17.6	100	0	0	100	0			Phone	National	1989	36
Male, boy/girl friends	0.79	192	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	17.6	100	0	0	100	0			Phone	National	1989	36
Female, close male friends	1.20	193	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	17.6	0	0	0	100	0			Phone	National	1989	36
Female, close female friends	1.17	193	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	17.6	0	0	0	100	0			Phone	National	1989	36
Female, boy/girl friends	0.44	193	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	17.6	0	0	0	100	0			Phone	National	1989	36
Crossman (2007)																						
Male	0.21	2068	Classmates	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	16.5	100	57	22	14				Student	National	1994	72
Female	1.04	2577	Classmates	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	16.5	0	57	22	14				Student	National	1994	72
D'Amico et al. (2006)	0.22	877	Friends	USA	9	5.1	4.2	Prop/Num	PUBH	Center	12	45	11	4	26				Student	School		36
de Vries et al. (2006)																						
Finland	-0.03	1243	Friends	Finland	37		4.8	Dichotomous	PUBH	UNIV	13.3	50	100	0	0	0			Student	National	1998	12
Denmark	-0.10	562	Friends	Denmark	26		3.6	Dichotomous	PUBH	UNIV	13.3	50	100	0	0	0			Student	National	1998	12
Netherland	-0.29	1987	Friends	Netherlands	20	3.3	3.8	Dichotomous	PUBH	UNIV	13.0	50	100	0	0	0			Student	National	1998	12
UK	-0.21	1746	Friends	UK	11	6.9		Dichotomous	PUBH	UNIV	12.8	50	100	0	0	0			Student	National	1998	12
Spain	0.33	647	Friends	Spain	49	5.4	5.5	Dichotomous	PUBH	UNIV	12.4	50	0	0	100	0			Student	National	1998	12
Portugal	1.16	907	Friends	Portugal	73	7.8	5.6	Dichotomous	PUBH	UNIV	12.7	50	0	0	100	0			Student	National	1998	12
Deutsch et al. (2015)																						
Average school cigarette use	0.62	475	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	15.6	53	64						Student	National	1994	12
Actual friend cigarette use	0.82	475	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	15.6	53	64						Student	National	1994	12
Perceived friend cigarette use	1.35	475	Classmates	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	15.6	53	64						Student	National	1994	12
Distefan et al. (1998)																						
Close male friends	0.30	4149	Close	USA	9	5.1	4.2	Dichotomous	MED	UNIV	15		66	15		2	20		Phone	National	1989	60
Close female friends	0.05	4149	Close	USA	9	5.1	4.2	Dichotomous	MED	UNIV	15		66	15		2	20		Phone	National	1989	60
Eaton. (2009)	0.15	2966	Friends	USA	9	5.1	4.2	Prop/Num	SOCI	UNIV	14.5	48		19			37		Phone	National	1989	60
Ellickson et al. (2001)																						
Friends	-0.25	2151	Friends	USA	9	5.1	4.2	Dichotomous	PUBH	Center	15.5	44	72	7	9	10	59		Student	Community	1985	60
Peers	0.00	2151	Peers	USA	9	5.1	4.2	Prop/Num	PUBH	Center	15.5	44	72	7	9	10	59		Student	Community	1985	60
Engels et al. (2004)																						
T1-T2	0.33	1196	Close	Netherlands	20	3.3	3.8	Prop/Num	MED	UNIV	12.3	50	100	0	0	0			Student	Community	2000	24
T2-T3	0.55	1101	Close	Netherlands	20	3.3	3.8	Prop/Num	MED	UNIV	12.3	50	100	0	0	0			Student	Community	2000	24
Flay et al. (1994)																						
Male	1.39	629	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	100	38	12	30	22			Student	Community	1986	15
Female	1.45	771	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	0	38	12	30	22			Student	Community	1986	15
White	1.23	533	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	45	100	0	0	0			Student	Community	1986	15
Black	1.43	174	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	45	0	100	0	0			Student	Community	1986	15
Hispanic	1.75	378	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	45	0	0	100	0			Student	Community	1986	15
Asian	1.25	311	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	45	0	0	0	100			Student	Community	1986	15
Flay et al. (1998)																						
Female: Triers vs. never users	0.41	778	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	0							Student	Community	1986	60
Male: Triers vs. never users	0.22	615	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	100							Student	Community	1986	60
Female: Experimenters vs. never users	0.73	1021	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	0							Student	Community	1986	60
Male: Experimentors vs. never users	0.65	807	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	100							Student	Community	1986	60
Female: Regular smokers vs. never users	0.74	721	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	0							Student	Community	1986	60
Male: Regular smokers vs. never users	0.74	588	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	12	100							Student	Community	1986	60
Go et al. (2010)	0.39	913	Friends	USA	9	5.1	4.2	Dichotomous	NA	Center	14.5	48	68						Student	National	1994	12
Go et al. (2012)	0.59	2065	Close	USA	9	5.1	4.2	Dichotomous	NA	Center	14.5	49	57	15	14	11	42	56	Student	Community		12

	ES	N	Interpersonal Closeness	Country/ Region	COL	Tightness	GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Goldade et al. (2012)	1.07	1959	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	12.5	49	84				34	79	Phone	Regional	2000	14
Griz et al. (2003)																						
White	1.62	278	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	12.9	37	100	0	0	0		54	Student	Community		12
Black	0.83	247	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	12.9	37	0	100	0	0		54	Student	Community		12
Hispanic	1.31	134	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	12.9	37	0	0	100	0		54	Student	Community		12
Harakeh et al. (2007)																						
Older sibling	0.90	220	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	15.2	53							Other	National	2002	12
Younger sibling	0.78	272	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	13.3	48	95						Other	National	2002	12
Harrabi et al. (2009)	1.69	441	Close	Tunisia				Dichotomous	PUBH	Other	13.5	43							Student	Regional	1999	48
Hiemstra et al. (2011)	0.37	272	Friends	Netherlands	20	3.3	3.8	Prop/Num	Other	UNIV	13.3	48	95				48		Other	National	2002	60
Hiemstra et al. (2012)																						
Friends, mother communication	0.29	272	Friends	Netherlands	20	3.3	3.8	Prop/Num	Other	UNIV	13.3	48	95						Other	National	2002	12
Close friends, mother communication	0.10	272	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	13.3	48	95						Other	National	2002	12
Friends, father communication	0.29	272	Friends	Netherlands	20	3.3	3.8	Prop/Num	Other	UNIV	13.3	48	95						Other	National	2002	12
Close friends, father communication	0.11	272	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	13.3	48	95						Other	National	2002	12
Hiemstra et al. (2014)																						
Friends, 1st wave at 2010	0.63	991	Friends	Netherlands	20	3.3	3.8	Dichotomous	Other	UNIV	12.5	47	95				52		Other	Regional	2010	60
Close friends, 1st wave at 2010	0.44	991	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	12.5	47	95				52		Other	Regional	2010	60
Friends, 1st wave at 2002	0.51	365	Friends	Netherlands	20	3.3	3.8	Dichotomous	Other	UNIV	14.2	47	95				52		Other	National	2002	60
Close friends, 1st wave at 2002	0.11	365	Close	Netherlands	20	3.3	3.8	Cigs	Other	UNIV	14.2	47	95				52		Other	National	2002	60
Hoving et al. (2007)	0.68	2048	Friends	Netherlands	20	3.3	3.8	Prop/Num	PUBH	UNIV	13.3	100							Student	School	1998	12
Jackson (1998)	0.22	777	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	9	49	83						Student	Regional	1994	24
Jackson et al. (1998)	0.33	233	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	10	49	84	15					Student	Regional	1994	24
Kandel et al. (2004)	0.57	5374	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	14.8	50	53	29	18			61	Student	National	1994	12
Killen et al. (1997)																						
Female	0.62	463	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14.9	0	45	3	15	23			Student	Community		24
Male	0.25	481	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	15.1	100	45	3	15	23			Student	Community		24
Kim et al. (2006)																						
One close friend, Low SES	0.07	547	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						37	Student	National	1994	84
One close friend, Middle SES	0.52	336	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						72	Student	National	1994	84
One close friend, High SES	0.10	302	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						100	Student	National	1994	84
Two close friend, Low SES	0.35	487	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						37	Student	National	1994	84
Two close friend, Middle SES	1.07	300	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						72	Student	National	1994	84
Two close friend, High SES	0.79	279	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						100	Student	National	1994	84
Three close friend, Low SES	0.10	478	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						37	Student	National	1994	84
Three close friend, Middle SES	0.34	300	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						72	Student	National	1994	84
Three close friend, High SES	0.15	274	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	14.5	0						100	Student	National	1994	84
Lotrean et al. (2013)																						
Classmates	0.55	316	Classmates	Romania	70			Prop/Num	MED	UNIV	15.9	34					44		Student	Community	2004	16
Friends	0.74	316	Friends	Romania	70			Dichotomous	MED	UNIV	15.9	34					44		Student	Community	2004	16
Mahabee-Gittens et al. (2013)																						
Evolve from age 10 to 13	1.87	838	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	10	51	63	17	16			46	Other	National	1999	36
Evolve from age 11 to 14	0.83	750	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	11	51	63	17	16			46	Other	National	1999	36
Evolve from age 12 to 15	0.79	866	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	12	51	63	17	16			46	Other	National	1999	36
Evolve from age 13 to 16	0.61	757	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	13	51	63	17	16			46	Other	National	1999	36
Evolve from age 14 to 17	0.60	400	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	14	51	63	17	16			46	Other	National	1999	36
Evolve from age 15 to 17	0.09	306	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	15	51	63	17	16			46	Other	National	1999	24
Evolve from age 16 to 17	0.51	197	Friends	USA	9	5.1	4.2	Dichotomous	MED	Other	16	51	63	17	16			46	Other	National	1999	12
McKelvey et al. (2015)																						
Boys: Sibling(s) smoke	0.44	670	Close	Jordan	70			Dichotomous	Other	UNIV	12.7	100					49		Student	Community	2007	36
Girls: Sibling(s) smoke	0.91	784	Close	Jordan	70			Dichotomous	Other	UNIV	12.7	0					49		Student	Community	2007	36
Boys: Friends smoke	1.67	670	Friends	Jordan	70			Dichotomous	Other	UNIV	12.7	100					49		Student	Community	2007	36

	ES	N	Interpersonal Closeness	Country/ Region	COLTightness		GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Girls: Friends smoke	1.61	784	Friends	Jordan	70			Dichotomous	Other	UNIV	12.7	0					49		Student	Community	2007	36
McKelvey et al. (2014)																						
Boys: Sibling(s) smoke	0.88	561	Close	Jordan	70			Dichotomous	Other	UNIV	13	100					49		Student	Community	2008	36
Boys: Close friends smoke	1.21	561	Close	Jordan	70			Dichotomous	Other	UNIV	13	100					49		Student	Community	2008	36
Girls: Sibling(s) smoke cigarettes	1.14	682	Close	Jordan	70			Dichotomous	Other	UNIV	13	0					49		Student	Community	2008	36
Girls: Close friends smoke	1.76	682	Close	Jordan	70			Dichotomous	Other	UNIV	13	0					49		Student	Community	2008	36
McNeill et al. (1988)	0.96	2159	Friends	UK	11	6.9		Dichotomous	PSYCH	Center	12	52							Student	National	1983	30
Mercken et al. (2007)	0.89	1763	Close	Netherlands	20	3.3	3.8	Cigs	PUBH	Center	12.7	50	76						Student	National	1998	12
Milton et al. (2004)	1.68	195	Close	UK	11	6.9		Dichotomous	PUBH	UNIV	9	47	88						Student	Regional	1995	24
Mohammadpoorasl et al. (2010)																						
Never smoker to ever smoker	0.62	921	Friends	Iran	59			Dichotomous	PUBH	UNIV	16.3	100							Student	Regional	2005	12
Never smoker to regular smoker	0.61	804	Friends	Iran	59			Dichotomous	PUBH	UNIV	16.3	100							Student	Regional	2005	12
Mohammadpoorasl et al. (2014)																						
Never smoker to experimenter	0.50	3878	Friends	Iran	59			Dichotomous	PUBH	UNIV	15.7	43							Student	Regional	2010	12
Never smoker to regular smoker	0.60	3878	Friends	Iran	59			Dichotomous	PUBH	UNIV	15.7	43							Student	Regional	2010	12
Molyneux et al. (2003)																						
Close friends	2.48	1651	Close	UK	11	6.9		Dichotomous	MED	UNIV	14.8	52					48		Student	Community	2000	12
Classmates: 8.3-14.3% prevalence vs. 0-8% prevalence	0.22	830	Classmates	UK	11	6.9		Prop/Num	MED	UNIV	14.8	52					48		Student	Community	2000	12
Classmates: 14.8%-23.1% prevalence vs. 0-8% prevalence	0.18	885	Classmates	UK	11	6.9		Prop/Num	MED	UNIV	14.8	52					48		Student	Community	2000	12
Classmates: 23.5%-50% prevalence vs. 0-8% prevalence	0.58	829	Classmates	UK	11	6.9		Prop/Num	MED	UNIV	14.8	52					48		Student	Community	2000	12
Mrug et al. (2011)																						
Grade 11	1.50	120	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	15	53	67	19	12				Student	Community	2002	12
Grade 12	-0.51	120	Friends	USA	9	5.1	4.2	Prop/Num	NA	UNIV	16	53	67	19	12				Student	Community	2003	12
Nonnemaker (2002)																						
Male, experimenter classmates, to experimenter	0.26	5411	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	100	71	17	13				Student	National	1995	12
Female, experimenter classmates, to experimenter	1.31	5200	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	0	70	17	13				Student	National	1995	12
Male, regular smoker classmates, to experimenter	-0.29	5411	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	100	71	17	13				Student	National	1995	12
Female, regular smoker classmates, to experimenter	0.82	5200	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	0	70	17	13				Student	National	1995	12
Male, regular smoker classmates, to regular smoker	0.55	5411	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	100	71	17	13				Student	National	1995	12
female, regular smoker classmates, to regular smoker	0.78	5200	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	0	70	17	13				Student	National	1995	12
O'Loughlin et al. (1998)	0.83	1224	Friends	Canada	20		4.2	Dichotomous	PUBH	Other	11	47	40		22	36	41		Student	Regional	1993	12
O'Loughlin et al. (2009)	0.89	877	Friends	Canada	20		4.2	Dichotomous	MED	UNIV	12.7	50							Student	Community	1999	12
Otten et al. (2008)																						
Friends	1.08	6769	Friends	Netherlands	20	3.3	3.8	Prop/Num	PSYCH	UNIV	12.9	48							Student	National	2002	20
Close friends	0.85	6769	Close	Netherlands	20	3.3	3.8	Dichotomous	PSYCH	UNIV	12.9	48							Student	National	2002	20
Perrine et al. (2004)	0.15	359	Peers	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	11	45	45		29	26			Student	Community	1990	12
Pierce et al. (1996)	0.47	2704	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	15	42	71	17	8	4		100	NA	National	1989	12
Prinstein & Greca (2009)	1.83	250	Friends	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	10	40	46	13	37	4			Student	Community		72
Romer et al.																						
General friends	0.31	355	Peers	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.6	47	73	14	15	0.8			Phone	National	2008	12
General peers	0.48	325	Peers	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.6	47	73	14	15	0.8			Phone	National	2008	12
Rose et al. (1999)																						
Classmates	0.24	874	Close	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	12.8	44	97						Student	Regional	1980	12
Close friends	0.08	874	peers	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	12.8	44	97						Student	Regional	1980	12
Sargent et al. (2001)	0.18	371	Friends	USA	9	5.1	4.2	Dichotomous	MED	UNIV	12.5	50	96				45		Student	School	1996	36

	ES	N	Interpersonal Closeness	Country/ Region	COL	Tightness	GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Sargent et al. (2004)	0.89	2596	Friends	USA	9	5.1	4.2	Dichotomous	MED	UNIV	12.1	47	95						Student	Regional		20
Scal et al. (2003)																						
Girls 7-8 grades, close friends	1.77	349	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	12.5	0	75	9	14	2			Student	National	1995	12
Girls 7-8 grades, classmates	1.29	349	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	12.5	0	75	9	14	2			Student	National	1995	12
Girls 9-12 grades, close friends	0.95	610	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.5	0	71	11	12	6			Student	National	1995	12
Girls 9-12 grades, classmates	1.25	610	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.5	0	71	11	12	6			Student	National	1995	12
Boys 7-8 grades, close friends	1.18	318	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	12.5	100	76	10	9	5			Student	National	1995	12
Boys 7-8 grades, classmates	0.36	318	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	12.5	100	76	10	9	5			Student	National	1995	12
Boys 9-12 grades, close friends	0.68	642	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.5	100	66	14	14	6			Student	National	1995	12
Boys 9-12 grades, classmates	0.45	642	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15.5	100	66	14	14	6			Student	National	1995	12
Siennick et al. (2015)	1.50	372	Friends	USA	9	5.1	4.2	Dichotomous	Other	UNIV	11.5	50	90						Student	Regional	2003	36
Simons-Morton (2002)																						
Close friends	0.64	911	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	11	46	71	18					Student	School	1995	12
Classmates	0.15	911	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	Center	11	46	71	18					Student	School	1995	12
Simons-Morton (2004)																						
Close friends	0.14	924	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	11	53	75	18					Student	School	1995	9
Classmates	0.18	924	Classmates	USA	9	5.1	4.2	Prop/Num	PUBH	Center	11	53	75	18					Student	School	1995	9
Song et al. (2009)	0.18	242	Close	USA	9	5.1	4.2	Prop/Num	PSYCH	UNIV	14	45	53		15	26			Student	School	2002	9
Tang et al. (1998)																						
Other language environment	0.78	734	Close	Australia	10	4.4	4.1	Dichotomous	PUBH	UNIV	12.5								Student	School	1994	12
English speaking environment	0.85	2618	Close	Australia	10	4.4	4.1	Dichotomous	PUBH	UNIV	12.5								Student	School	1994	24
Tell et al. (1984)	0.11	441	Friends	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	11	50							NA	School	1979	24
Tucker et al. (2011)	0.73	4612	Close	USA	9	5.1	4.2	Prop/Num	NA	Center	14.8	46	47	27	16	9			Student	National	1995	24
Valente et al. (2013)																						
Peers	-0.01	1450	Peers	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14.5	41	7		80	7			Student	Community	2006	12
Close friends	0.36	1450	Close	USA	9	5.1	4.2	Prop/Num	MED	UNIV	14.5	41	7		80	7			Student	Community	2006	12
Vitaro et al. (2004)																						
Age 11-12	0.06	658	Friends	Canada	20		4.2	Cigs	NA	UNIV	11.5	50	90						NA	National		18
Age 12-13	0.14	702	Friends	Canada	20		4.2	Cigs	NA	UNIV	12.5	50	90						NA	National		12
Age 13-14	0.11	676	Friends	Canada	20		4.2	Cigs	NA	UNIV	13.5	50	90						NA	National		12
Wilkinson et al. (2009)																						
Mexican-born	0.10	380	Friends	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	11.8	49	0	0	100	0			Phone	Regional	2001	24
US-born	0.17	749	Friends	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	11.8	49	0	0	100	0			Phone	Regional	2001	24
Wills et al. (2007)	1.06	2611	Friends	USA	9	5.1	4.2	Prop/Num	MED	UNIV	12.1	47	94						Student	Community	1999	12
Xie et al. (2013)	0.33	3314	Peers	China	80	7.9	5.9	Prop/Num	COMM	UNIV	13.4	47	0	0	0	100		10	Student	Community		60
Yu & Whitbeck (2016)																						
Occasional vs. nonsmoking (wave 2 vs. wave 1)	-0.16	704	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50							NA	Community	2002	12
Frequent vs. nonsmoking (wave 2 vs. wave 1)	-0.01	704	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50							NA	Community	2002	12
Occasional vs. nonsmoking (wave 3 vs. wave 1)	0.51	694	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50							NA	Community	2002	24
Frequent vs. nonsmoking (wave 3 vs. wave 1)	0.91	694	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50							NA	Community	2002	24

Note. ES is in *ln (OR)* form which has been used in both weighted-mean effect size analyses and moderator analyses under RVE approach. COL: Hofstede collectivism score; GLOBE COL: GLOBE in-group collectivism practices scores; UNIV: University, Center: Research center; PSYCH: Psychology, PUBH: Public health, MED: Medicine, SOCI: Sociology, NA: Not identified; Phone: Public phone directory; Dichotomous: Smoking or not, Prop/Num: Proportion of peers smoking or numbers of peers smoking, Cigs: Amount of cigarettes consumption. %White: percent of the European background adolescents in the sample (note that Yu & Whitbeck (2016) focused on North American Indigenous adolescents thus their ethnicity was not counted as White); %Black: percent of the African background adolescents in the sample; % Hispanic: percent of the Hispanic background adolescents in the sample; % Asian: percent of the Asian background adolescents in the sample. % Parent Edu: percent of adolescents who had at least one parent with at least some college education in the sample. Due to the limit of space, we could not include information for all the moderators. Information about other moderators will be available upon request.

Table 2

Effect Sizes and Moderator Values (Levels) in Continuation Studies Sample

	ES	N	Interpersonal Closeness	Country/ Region	COL Tightness		GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% Parent Edu	Sample Frame	Population	1st Wave	Length (month)
Ayatollahi et al. (2005)	0.43	191	Close	Iran	59			Prop/Num	PUBH	UNIV	15.95	100							Phone	Regional	2003	8
Bauman et al. (2001)																						
Experimental smokers to occasional smokers, age < 15	0.45	662	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15						66		Student	National	1994	36
Experimental smokers to occasional smokers, age > 16	0.17	427	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	16						65		Student	National	1994	36
Occasional smokers continue to smoke, age < 15	0.48	1276	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15						70		Student	National	1994	36
Occasional smokers continue to smoke, age > 16	0.48	1132	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	16						67		Student	National	1994	36
Frequent smokers continue to smoke, age < 15	0.71	430	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15						86		Student	National	1994	36
Frequent smokers continue to smoke, age > 16	0.87	698	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	16						74		Student	National	1994	12
Experimental smokers to occasional smokers, male	-0.03	495	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	100					66		Student	National	1994	12
Experimental smokers to occasional smokers, female	0.69	594	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	0					65		Student	National	1994	12
Occasional smokers continue to smoke, male	0.48	1131	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	100					67		Student	National	1994	12
Occasional smokers continue to smoke, female	0.47	1277	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	0					71		Student	National	1994	12
Frequent smokers continue to smoke, male	0.18	539	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	100					78		Student	National	1994	12
Frequent smokers continue to smoke, female	1.42	589	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	0					79		Student	National	1994	12
Experimental smokers to occasional smokers, white	0.20	650	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		100	0	0	0	70		Student	National	1994	12
Experimental smokers to occasional smokers, black	0.52	293	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	100	0	0	59		Student	National	1994	12
Experimental smokers to occasional smokers, Hispanic	0.55	146	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	0	100	0	60		Student	National	1994	12
Occasional smokers continue to smoke, white	0.37	1699	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		100	0	0	0	72		Student	National	1994	12
Occasional smokers continue to smoke, black	0.85	402	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	100	0	0	63		Student	National	1994	12
Occasional smokers continue to smoke, Hispanic	0.68	307	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	0	100	0	62		Student	National	1994	12
Frequent smokers continue to smoke, white	0.82	974	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		100	0	0	0	79		Student	National	1994	12
Frequent smokers continue to smoke, black	0.88	47	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	100	0	0	74		Student	National	1994	12
Frequent smokers continue to smoke, Hispanic	0.19	107	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15		0	0	100	0	71		Student	National	1994	12
Bricker et. al. (2006)																						
Experimenter to monthly smoker	0.17	3131	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	13	51	91			1.6	44		Student	Regional	1984	108
Monthly smoker to daily smoker	0.16	1753	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	13	51	91			1.6	44		Student	Regional	1984	108
Chen et al. (2006)																						
Males, close friends	1.68	388	Close	China	80	7.9	5.9	Dichotomous	MED	UNIV	15.3	100	0	0	0	100			Student	Regional	2003	60

	ES	N	Interpersonal Closeness	Country/ Region	COL Tightness		GLOBE COL	Influence Measure	Author Area	Author Institution	Mean Age	% Male	% White	% Black	% Hispanic	% Asian	% Parent Smoke	% arent Edu	Sample Frame	Population	1st Wave	Length (month)
Females, close friends	0.59	419	Close	China	80	7.9	5.9	Dichotomous	MED	UNIV	15.8	0	0	0	0	100			Student	Regional	2003	60
Males, peers	0.98	389	Peers	China	80	7.9	5.9	Prop/Num	MED	UNIV	15.3	100	0	0	0	100			Student	Regional	2003	36
Females, peers	0.56	422	Peers	China	80	7.9	5.9	Prop/Num	MED	UNIV	15.8	0	0	0	0	100			Student	Regional	2003	60
Distefan et al. (1998)																						
Close male friends	0.36	2684	Close	USA	9	5.1	4.2	Dichotomous	MED	UNIV	15		66	15		2	30		Phone	National	1989	60
Close female friends	0.42	2684	Close	USA	9	5.1	4.2	Dichotomous	MED	UNIV	15		66	15		2	30		Phone	National	1989	60
Ellickson et al. (2008)																						
Grade 7 to grade 12	0.24	1960	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	12	52	70	9	11	6			Student	Community		60
Grade 10 to grade 12	0.53	1960	Close	USA	9	5.1	4.2	Prop/Num	PUBH	Center	12	52	70	9	11	6			Student	Community		24
Flay et al. (1994)	0.23	518	Close	USA	9	5.1	4.2	Dichotomous	NA	UNIV	12	46	37	11	30	21			Student	Community	1986	15
Flint et al. (1998)	0.78	2467	Close	USA	9	5.1	4.2	Dichotomous	PUBH	UNIV	15	52	86	14			49	28	Other	National	1989	12
Kandel et al. (2004)	1.04	4474	Close	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	15	49	57	23	20			59	Student	National	1994	12
Mohammadpoorasl et al. (2010)	0.39	216	Friends	Iran	59			Dichotomous	PUBH	UNIV	16.3	100							Student	Regional	2005	12
Mohammadpoorasl et al. (2014)	0.69	765	Friends	Iran	59			Dichotomous	PUBH	UNIV	15.7	43							Student	Regional	2005	12
Nonnemaker (2002)																						
Male, regular smoker classmates, experimenter to regular smoker	0.59	1203	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	100	71	17	13	0			Student	National	1995	12
Female, regular smoker classmates, experimenter to regular smoker	0.04	1155	Classmates	USA	9	5.1	4.2	Prop/Num	NA	UNIV	14.5	0	70	17	13	0			Student	National	1995	12
O'Loughlin et al. (1998)																						
Male sibling	0.59	229	Close	Canada	20		4.2	Dichotomous	PUBH	Other	11	47	49		14	34	41		Student	Regional	1993	12
Female sibling	0.99	156	Close	Canada	20		4.2	Dichotomous	PUBH	Other	11	53	54		21	23	41		Student	Regional	1993	12
Male friend	0.74	229	Friends	Canada	20		4.2	Dichotomous	PUBH	Other	11	47	49		14	34	41		Student	Regional	1993	12
Female friend	0.98	156	Friends	Canada	20		4.2	Dichotomous	PUBH	Other	11	53	54		21	23	41		Student	Regional	1993	12
O'Loughlin et al. (2009)	1.97	411	Friends	Canada	20		4.2	Dichotomous	MED	UNIV	12.7	50							Student	Community	1999	12
Park et al. (2009)																						
Experimenter to temporary daily smoking	0.29	4637	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	15.4	48	52	21	19	9		68	Student	National	1994	12
Experimenter to Continued daily smoking	0.42	4407	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	15.4	48	52	21	19	9		68	Student	National	1994	12
Pierce et al. (1996)	0.51	4500	Close	USA	9	5.1	4.2	Dichotomous	PSYCH	UNIV	15	42	71	17	8	4		100	NA	National	1989	12
Sznitman and Romer																						
General friends	0.61	114	Peers	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	16.6	57	71	7.8	1.4	1.6			Phone	National	2008	12
General peers	0.37	98	Peers	USA	9	5.1	4.2	Prop/Num	PUBH	UNIV	16.6	57	71	7.8	1.4	1.6			Phone	National	2008	12
Tucker et al. (2011)	0.45	2837	Close	USA	9	5.1	4.2	Prop/Num	NA	Center	15.1	50	49	25	19	6			Student	National	1995	18
Xie et al. (2013)	1.28	1747	Peers	China	80	7.9	5.9	Prop/Num	COMM	UNIV	13.4	47	0	0	0	100		10	Student	Community		60
Yu & Whitbeck (2016)																						
frequent vs. occasional smoking (wave 2 vs. wave 1)	0.18	704	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50	0	0	0	0			NA	Community	2002	12
frequent vs. occasional smoking (wave 3 vs. wave 1)	0.89	694	Close	USA	9	5.1	4.2	Prop/Num	Other	UNIV	11.5	50	0	0	0	0			NA	Community	2002	12

Note. ES is in *ln (OR)* form which has been used in both weighted-mean effect size analyses and moderator analyses under RVE approach. COL: Hofstede collectivism score; GLOBE COL: GLOBE in-group collectivism practices scores; UNIV: University, Center: Research center; PSYCH: Psychology, PUBH: Public health, MED: Medicine, SOCI: Sociology, NA: Not identified; Phone: Public phone directory; Dichotomous: Smoking or not, Prop/Num: Proportion of peers smoking or numbers of peers smoking, Cigs: Amount of cigarettes consumption. %White: percent of the European background adolescents in the sample (note that Yu & Whitbeck (2016) focused on North American Indigenous adolescents thus their ethnicity was not counted as White); %Black: percent of the African background adolescents in the sample; % Hispanic: percent of the Hispanic background adolescents in the sample; % Asian: percent of the Asian background adolescents in the sample. % Parent Edu: percent of adolescents who had at least one parent with at least some college education in the sample. Due to the limit of space, we could not include information for all the moderators. Information about other moderators will be available upon request.

Table 3

Descriptive Statistics for Moderators

Theoretical Moderators	Initiation		Continuation	
Interpersonal Closeness of Peers [a]	*k*	*%*	*k*	*%*
Close friends	87	47.3	40	75.5
Friends	61	33.2	7	13.2
Classmates	26	14.1	3	5.7
General peers	10	5.4	3	5.7
Hofstede Collectivism (COL)	*Mean*	*SD*	*Mean*	*SD*
	18.37	19.95	19.98	23.31
	Min	*Max*	*Min*	*Max*
	9	83	9	80
Tightness	*Mean*	*SD*	*Mean*	*SD*
	5.06	0.98	5.43	0.91
	Min	*Max*	*Min*	*Max*
	3.3	10	5.1	7.9
GLOBE In-group Collectivism Practices	*Mean*	*SD*	*Mean*	*SD*
	4.21	0.32	4.39	0.51
	Min	*Max*	*Min*	*Max*
	3.63	5.86	4.22	5.86
Methodological Moderators				
	k	*%*	*k*	*%*
Peer Norms Measurement				
Smoking or not	83	45.1	36	67.9
Proportion of peer smoking	90	48.9	17	32.1
Amount of cigarettes consumption	11	6.0	—	—
Sampling Frame [b]				
School students	129	70.1	45	84.9
Public phone directory	22	12.0	4	7.5
Other	18	9.8	1	1.9
Not identified	15	8.2	3	5.7
Participant Population				
National	90	48.9	33	62.3
Regional	19	10.3	13	24.5
Community	58	31.5	7	13.2
School	17	9.2	—	—
Effect Size after being Adjusted by Covariates	114	62.0	20	37.7
	Mean	*SD*	*Mean*	*SD*
Distance between Two Waves (in months)	30.93	28.42	25.22	23.65
Total No. of covariates	9.40	7.28	11.88	5.50
No. of demographics covariates	3.79	4.39	5.29	4.81
No. of smoking-related covariates	0.75	1.09	1.76	1.25
No. of general environmental covariates	2.46	2.65	2.29	2.02
No. of smoking-related environmental covariates	2.40	2.16	2.53	1.70
	Median		*Median*	
Year of 1st wave	1997		1994	

Study Descriptive Moderators	Initiation		Continuation	
Country where study was conducted [c]	*k*	*%*	*k*	*%*
Australia (COL = 10)	2	1.1	—	—
Canada (COL = 20)	5	2.7	5	9.4
China (COL = 80)	1	0.5	5	9.4
Denmark (COL = 26)	3	1.6	—	—
Finland (COL = 37)	1	0.5	—	—
Iran (COL = 59)	5	2.7	3	5.7
Jordan (COL = 70)	8	4.3	—	—
Netherlands (COL = 20)	18	9.8	—	—
Portugal (COL = 73)	1	0.5	—	—
Romania (COL = 70)	2	1.1	—	—
South Korea (COL = 82)	2	1.1	—	—
Spain (COL = 49)	1	0.5	—	—
Taiwan (COL = 83)	2	1.1	—	—
Tunisia (COL = NA)	1	0.5	—	—
United Kingdom (COL = 11)	7	3.8	—	—
United States (COL = 9) [d]	125	67.9	40	75.5
Publication Type				
Published	173	94.0	49	92.5
Unpublished	11	6.0	4	7.5
First Author Research Area [e]				
Psychology	19	10.3	1	1.9
Public health	70	38.0	36	67.9
Medicine	41	22.3	7	13.2
Communication	1	0.5	1	1.9
Sociology	3	1.6	—	—
Other	24	13.0	4	7.5
Not identified	26	14.1	4	7.5
First Author Institution Type [f]				
University	151	82.1	44	83.0
Research center	24	13.0	5	9.4
Other	9	4.9	4	7.5
	Mean	*SD*	*Mean*	*SD*
Age (mean age in years)	13.72	1.71	14.46	1.58
Gender – Proportion of male	0.47	0.30	0.53	0.32
Proportion of European background	0.58	0.36	0.42	0.37
Proportion of African background	0.12	0.20	0.17	0.29
Proportion of Asian background	0.20	0.36	0.19	0.34
Proportion of Hispanic background	0.23	0.34	0.18	0.28
Proportion of parent smoke	0.46	0.11	0.61	0.15
Proportion of parent education (≥ college)	0.59	0.24	0.56	0.32
	Median		*Median*	
Publication year	2006		2001	

Note: k = number of cases within each level of categorical moderators, or total number of cases for continuous moderators; the total number might not add up to 184 for initiation and 53 for continuation within each moderator due to missing values, i.e., not identified in the studies. COL: Hofstede collectivism score. [a] *Friends*, *classmates* and *general peers* were grouped into a single category *general friends and peers* in the moderator analyses. [b] *Public phone directory*, *other* and *not identified* were combined into a single category *other* in the moderator analyses due to insufficient sample sizes for these subcategories especially in the continuation sample. [c] Country information was collected during coding and later was used to assign collectivism scores. [d] Yu & Whitbeck (2016) collected data in North America but focused on Indigenous youth thus COL was considered NA. [e] *Communication*, *sociology*, *other* and *not identified* were grouped into a single category *other* in the moderator analyses. [f] *Research center* and *other* were grouped into a single category *other* in the moderator analyses.

Table 4

Weighted-Mean Effect Size and Moderator Analyses for Smoking Initiation

$\overline{OR}$	*95% CI*	*OR N.*		Study *N.*	I^2
1.96	1.76 – 2.19	184		71	94%
		k	*n*	$\overline{OR}$	*β (95% CI)*
Theoretical Moderators					
Interpersonal Closeness of Peers		184	71		
General friends and peers (base category)		97	45	1.78	–
Close friends		87	39	2.20	0.22 (0.00 – 0.43)*
Collectivism [a]		179	69		0.01 (0.00 – 0.02)*
Exploratory Moderators					
Methodological Moderators					
Peer Behavior Measurement		184	71		
Smoking or not (base category)		83	36	2.27	–
Proportion of peer smoking		90	38	1.77	-0.25 (-0.48 – -0.02)*
Amount of cigarette consumption		11	6	1.49	-0.42 (-0.87 – 0.03)†
Year of 1st Wave		171	63		0.01 (-0.02 – 0.03)
Sampling Frame		184	71		
School students (base category)		129	54		–
Other		55	17		-0.13 (-0.37 – 0.11)
Participant Population		184	71		
National (base category)		90	26		–
Regional		19	14		-0.04 (-0.32 – 0.25)
Community		58	21		0.15 (-0.12 – 0.42)
School		17	11		-0.01 (-0.46 – 0.44)
Distance between Two Waves		184	71		-0.00 (-0.01 – 0.00)
Effect Size Adjusted or Not (base category = No)		184	71		-0.08 (-0.32 – 0.16)
No. of Covariates		120	41		-0.01 (-0.09 – 0.08)
No. of Demographic Covariates		120	41		-0.01 (-0.21 – 0.19)
No. of Individual Smoking Related Covariates		120	41		-0.05 (-0.21 – 0.11)
No. of General Environmental Covariates		120	41		-0.03 (-0.16 – 0.10)
No. of Smoking Related Environmental Covariates		120	41		-0.00 (-0.09 – 0.09)
Study Descriptive Moderators					
Publication Type		184	71		–
Unpublished (base category)		11	4		
Published		173	67		0.18 (-0.17 – 0.52)
First Author Research Area		184	71		
Public health (base category)		70	27		–
Psychology		19	11		0.09 (-0.29 – 0.47)
Medicine		41	14		0.07 (-0.18 – 0.32)
Other		54	19		0.07 (-0.25 – 0.40)
First Author Institution Type		184	71		
University (base category)		151	56		–
Other		33	15		-0.11 (-0.40 – 0.17)
Publication Year		182	70		-0.00 (-0.02 – 0.02)
Age		184	71		-0.01 (-0.09 – 0.07)
Gender – Proportion of male		172	69		-0.16 (-0.51 – 0.19)
Proportion of European background		133	53		-0.50 (-0.93 – -0.08)*
Proportion of African background		94	34		-0.58 (-1.32 – 0.16)
Proportion of Hispanic background		91	33		0.01 (-0.69 – 0.71)
Proportion of Asian background		86	29		0.49 (0.09 – 0.90)*
Proportion of parent smoke		43	17		0.04 (-3.33 – 3.42)
Proportion of parent education (≥ college)		24	8		-0.02 (-0.99 – 0.96)

Note. $\overline{OR}$ = weighted-mean effect size in the form of odds ratio. *k* = number of effect sizes; the total number might not add up to 184 for each moderator due to missing values, e.g., not identified in the studies. *n* = number of studies. *β* = standardized meta-regression coefficients. For categorical moderators, post-hoc comparisons among $\overline{OR}$s of subcategories of a moderator were conducted only if the overall test was significant. To determine the significance of simple effects, a two-tailed criterion was used. [a] Collectivism refers to the Hofstede collectivism scores. Moderator analyses using the two other national culture indices show similar patterns of moderation effects in the overall dataset (initiation and continuation samples combined), thus separate moderator analysis for the initiation sample was only conducted using the Hofstede collectivism scores, which have way fewer missing values compared to the other indices.

† $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5
Weighted-Mean Effect Size and Moderator Analyses for Smoking Continuation

$\overline{OR}$	*95% CI*	*OR N.*	Study *N.*	I^2
1.78	1.55 – 2.05	53	20	93%

	k	*n*	$\overline{OR}$	*β (95% CI)*
Theoretical Moderators				
Interpersonal Closeness of Peers	53	20		
General friends and peers (base category)	12	8	2.15	–
Close friends	41	14	1.70	-0.23 (-0.62 – 0.16)
Collectivism [a]	51	19		0.01 (0.00 – 0.01)*
Exploratory Moderators				
Methodological Moderators				
Peer Behavior Measurement	53	20		
Smoking or not (base category)	36	11	1.89	–
Proportion of peer smoking	17	10	1.60	-0.16 (-0.44 – 0.12)
Year of 1st Wave	50	18		0.02 (-0.00 – 0.04)†
Sampling Frame	53	20		
School students (base category)	45	15		–
Other	8	5		-0.07 (-0.30 – 0.16)
Participant Population	53	20		
National (base category)	33	9		–
Regional	13	6		0.13 (-0.30 – 0.57)
Community	7	5		0.21 (-0.44 – 0.86)
Distance between Two Waves	53	20		-0.00 (-0.01 – 0.01)
Effect Size Adjusted or Not (base category = No)	53	20		-0.02 (-0.31 – 0.27)
No. of Covariates	17	12		-0.01 (-0.11 – 0.12)
No. of Demographic Covariates	17	12		-0.00 (-0.14 – 0.14)
No. of Individual Smoking Related Covariates	17	12		-0.07 (-0.08 – 0.22)
No. of General Environmental Covariates	17	12		-0.01 (-0.07 – 0.10)
No. of Smoking Related Environmental Covariates	17	12		-0.04 (-0.18 – 0.27)
Study Descriptive Moderators				
Publication Type	53	20		
Unpublished (base category)	4	2		–
Published	49	18		0.20 (-0.79 – 1.20)
First Author Research Area	53	20		
Public health (base category)	36	10		–
Psychology	1	1		-0.04 (-0.13 – 0.06)
Medicine	7	3		0.34 (-0.19 – 0.87)
Other	9	6		-0.06 (-0.33 – 0.21)
First Author Institution Type	53	20		
University (base category)	44	16		–
Other	9	4		-0.14 (-0.63 – 0.35)
Publication Year	51	19		0.01 (-0.01 – 0.03)
Age	53	20		-0.02 (-0.11 – 0.08)
Gender – Proportion of male	36	19		-0.04 (-1.66 – 1.58)
Proportion of European background	39	18		-0.38 (-0.83 – 0.08)†
Proportion of African background	31	14		0.03 (-4.38 – 4.43)
Proportion of Hispanic background	32	13		-0.23 (-3.56 – 3.11)
Proportion of Asian background	37	16		0.61 (-0.29 – 1.50)†
Proportion of parent smoke	30	5		0.32 (-1.50 – 2.14)
Proportion of parent education ((≥ college)	6	5		-0.86 (-2.55 – 0.82)

Note. $\overline{OR}$ = weighted-mean effect size in the form of odds ratio. *k* = number of effect sizes; the total number might not add up to 53 within each moderator due to missing values, e.g., not identified in the studies. *n* = number of studies. *β* = standardized meta-regression coefficients. For categorical moderators, post-hoc comparisons among $\overline{OR}$s of subcategories of a moderator were conducted only if the overall test was significant. To determine the significance of simple effects, a two-tailed criterion was used. [a] Collectivism refers to the Hofstede collectivism scores. Moderator analyses using the two other national culture indices show similar patterns of moderation effects in the overall dataset (initiation and continuation samples combined), thus separate moderator analysis for the continuation sample was only conducted using the Hofstede collectivism scores, which have way fewer missing values compared to the other indices.
† $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1. PRISMA flow chart of published studies retrieval and selection procedures

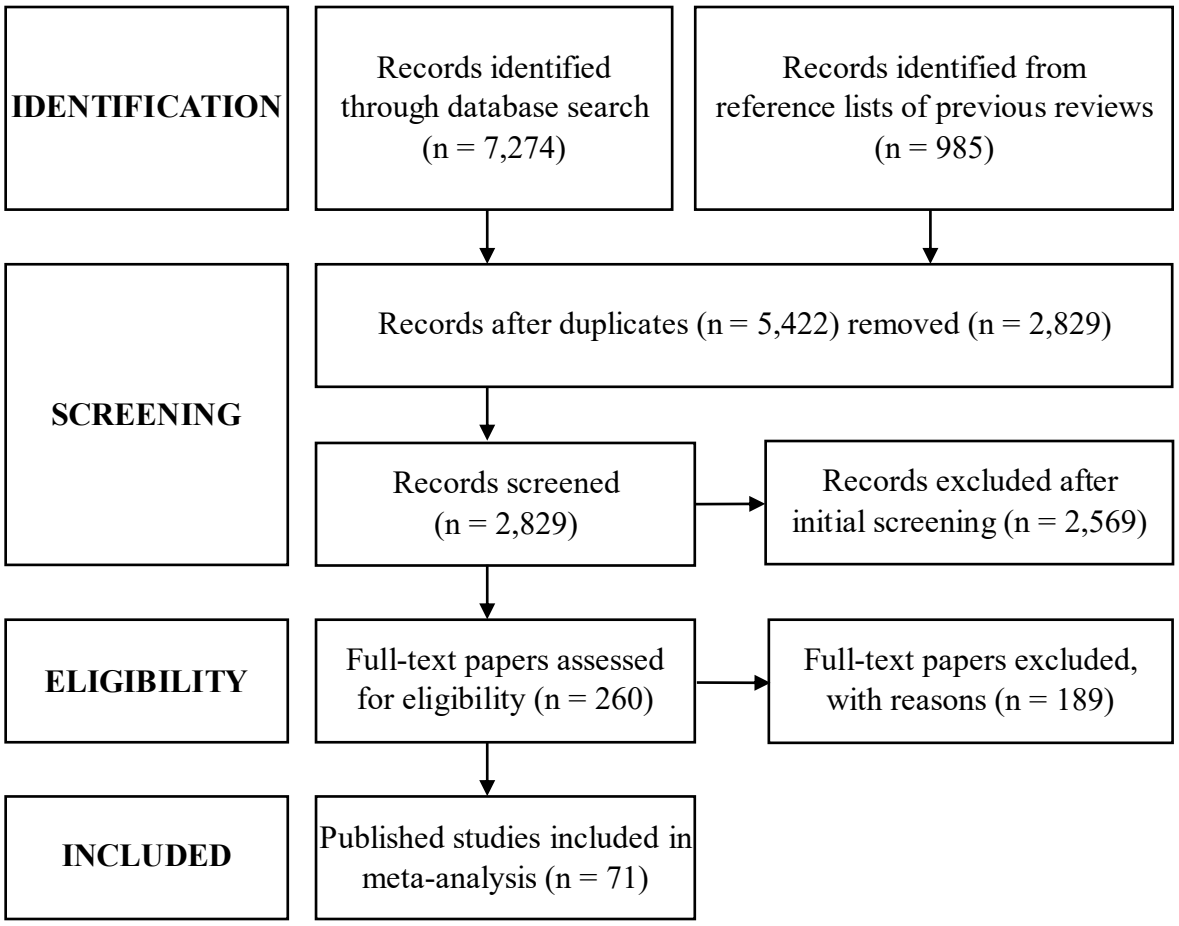


Figure 2A. Forest plot for initiation studies

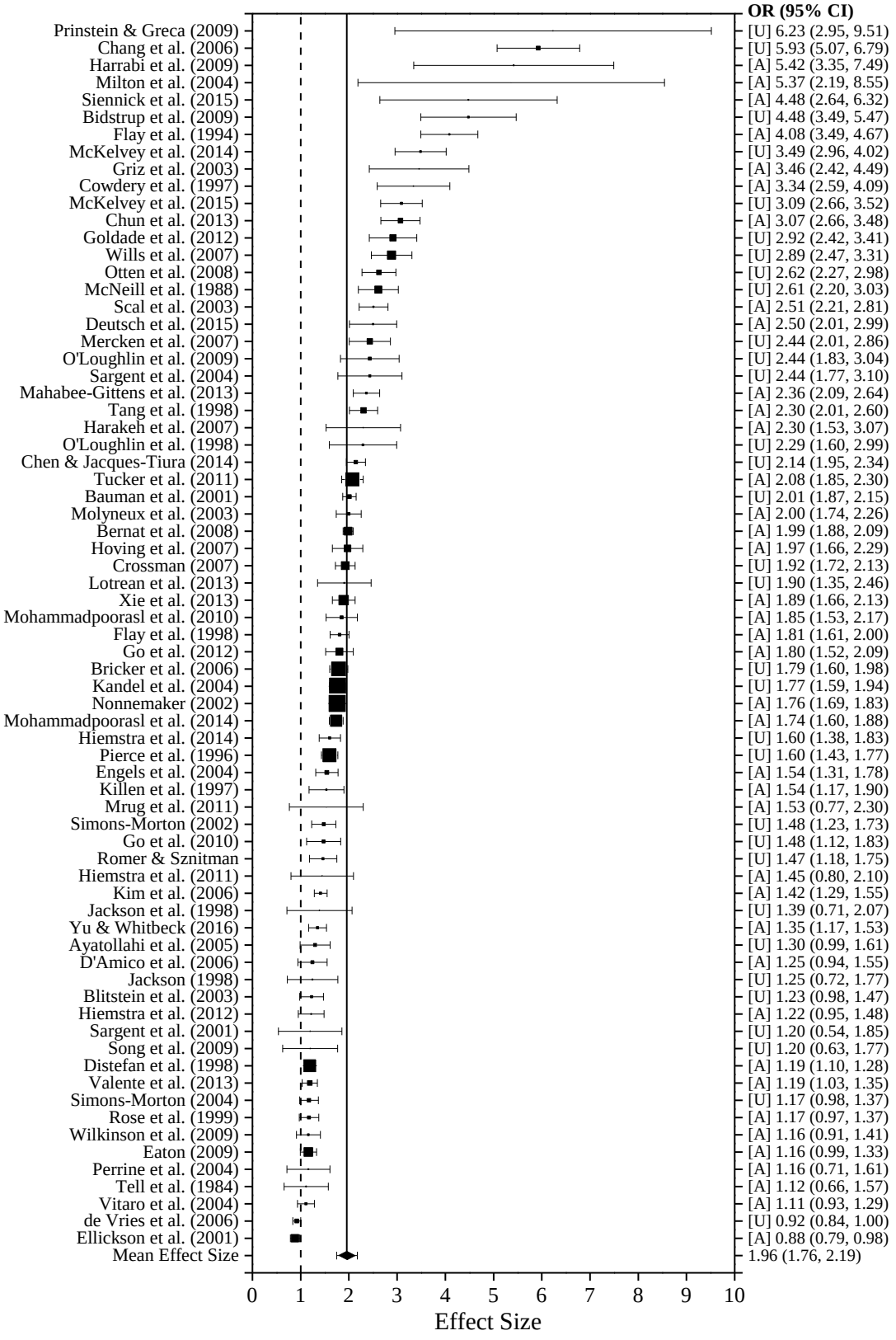
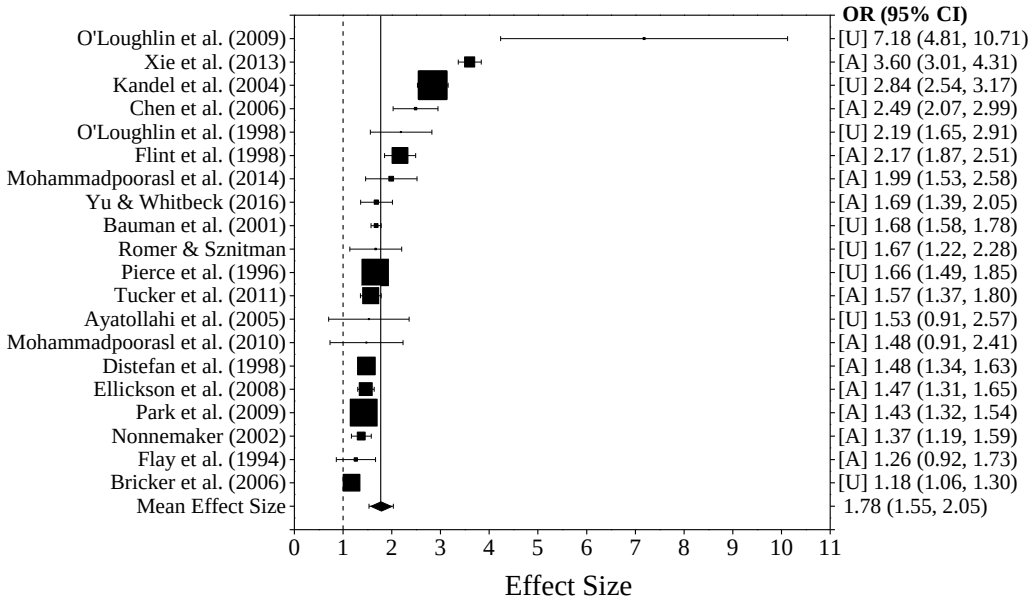


Figure 2B. Forest plot for continuation studies



Note: In Figures 2A and 2B, the boxes represent the point estimate of effects and is proportionate to the weight assigned to this study in the meta-analysis. Each line extending out of each box is the 95% CI for that particular study. The vertical dotted line represents "the line of no effect", i.e., peer behavior has no effect on adolescents' smoking outcomes. The diamond represents the overall or weighted-mean effect size from the meta-analysis estimated by the RVE approach. Both edges of the diamond are right to the line of no effect and this represents that the overall effect size is significantly larger compared to OR = 1. [U] indicates unadjusted effect sizes, and [A] indicates adjusted effect sizes.

Figure 3A. Funnel plot for initiation studies (study level)

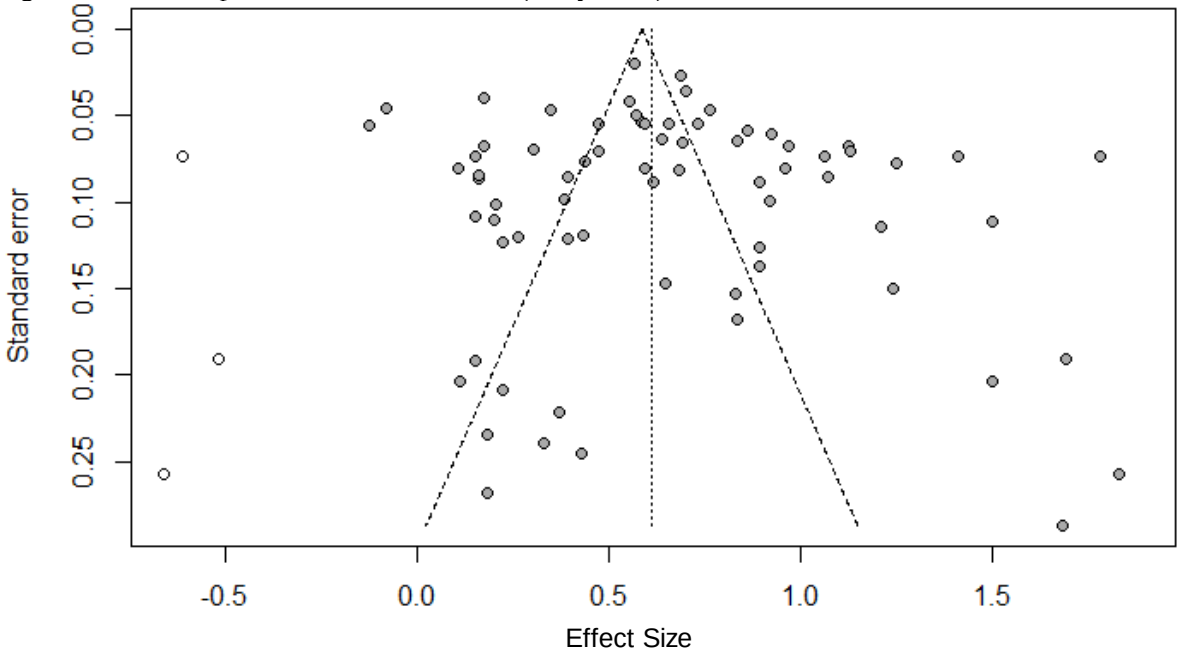


Figure 3B. Funnel plot for continuation studies (study level)

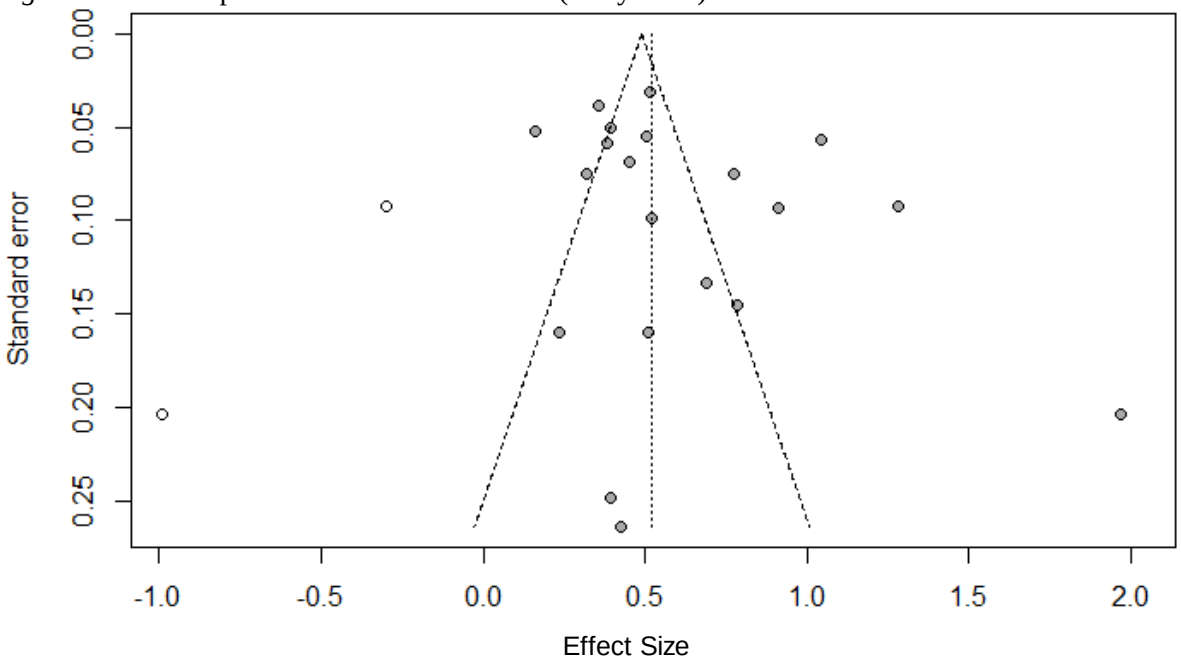


Figure 3C. Funnel plot for initiation studies (effect size level)

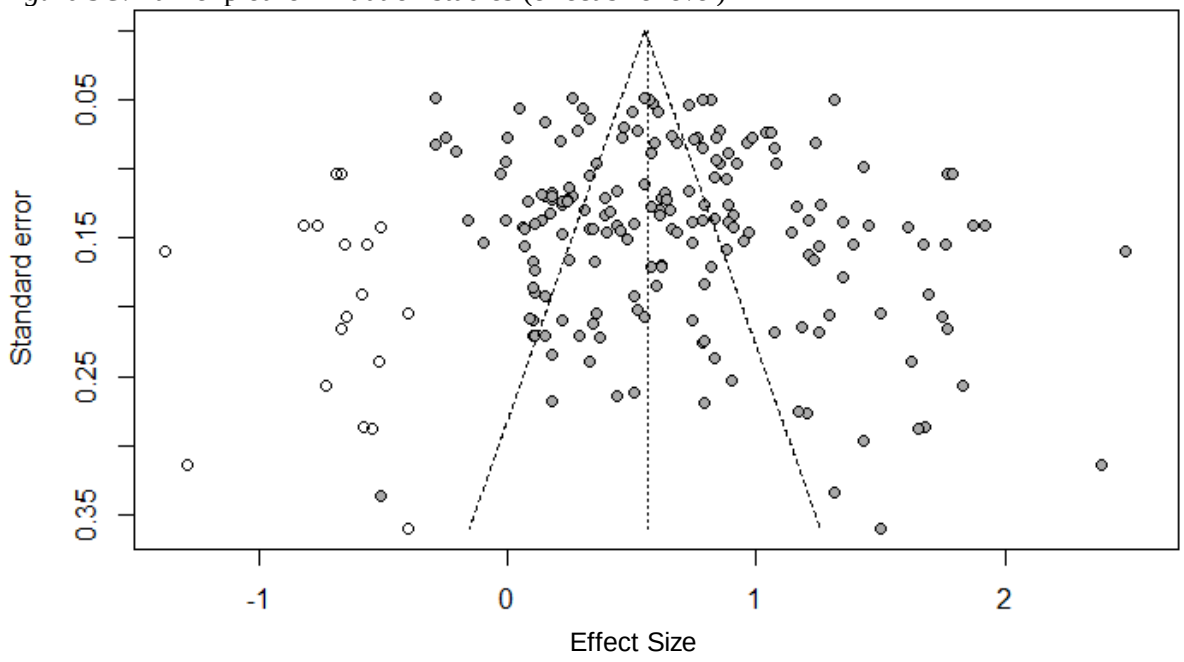
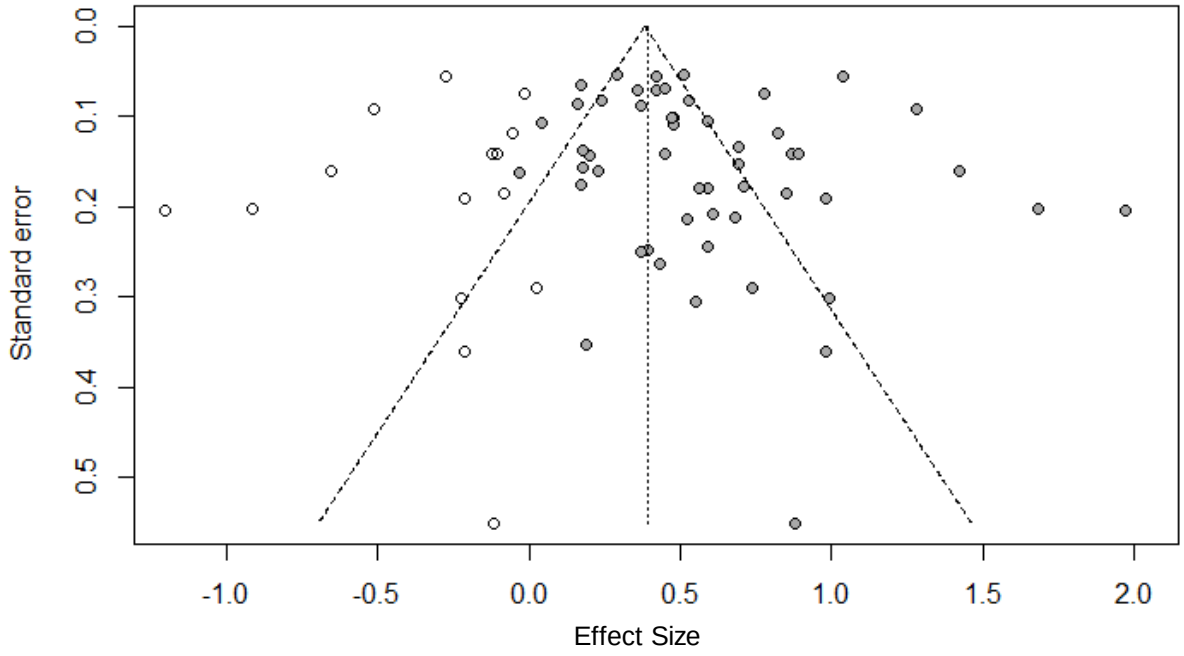


Figure 3D. Funnel plot for continuation studies (effect size level)



Note: In Figures 3A – 3D, effect size ln (OR) is plotted on the *X*-axis and the measure of effect size precision. i.e., standard error on the *Y*-axis (in decreasing order). The dotted vertical line shows the weighted-mean effect size (without taking into consideration of the dependency among effect sizes that are nested within same studies). The solid dots represent the observed effect sizes in the samples, and the hollow dots represent the "filled" effect sizes as estimated by the trim-and-fill method. Figures 3A and 3B describe the distributions of the study-level effect sizes (by collapsing individual effect sizes within the same study with weights), and exhibit a more symmetrical triangular shape with fewer filled data points relative to Figures 3C and 3D, which display all the observed individual effect sizes and appear to be more skewed.

Figure 4A. Weighted-mean effect sizes across collectivism levels in the initiation sample

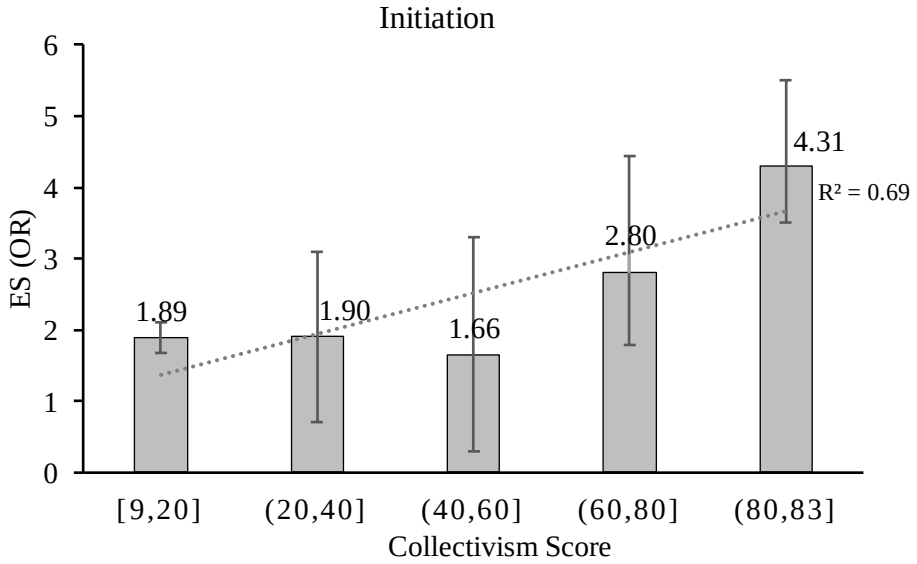
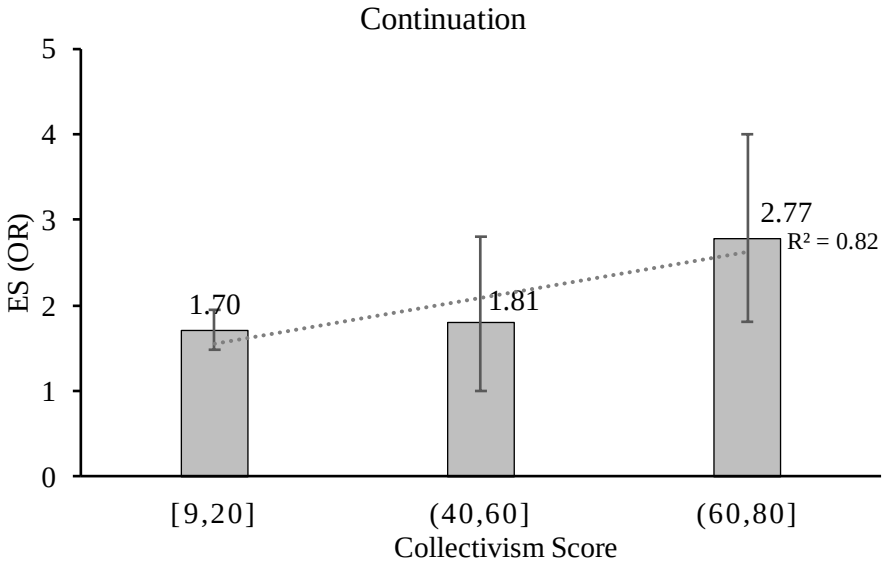


Figure 4B. Weighted-mean effect sizes across collectivism levels in the continuation sample



Note. Figures 4A and 4B visually present the univariate relation between collectivism scores and weighted-mean effect sizes in the initiation and continuation samples, respectively. The *Y*-axis presents odds ratios. Collectivism scores were aggregated into intervals to maximize the number of effects. Each effect size estimate was calculated with the RVE approach. In Figure 4B, omitted intervals had no effect sizes. Error bars represent 95% confidence intervals of the weighted-mean effect size in each interval. Linear trends are plotted on top of the bar graphs, with R^2 indicating the fit of the trend lines to the data series.