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Toward a Determination of Adolescent Age-Graded Differences in Predictors of Cigarette Initiation

Rebecca J. Howell[1]

Abstract: The study provided a systematic appraisal of predictors of cigarette initiation among American youth, in an effort to identify age-specific differences in factors emanating from the five ecological domains of influence. Using a rigorous inclusion criteria and standardized analytic techniques, investigated were 200 directional effects culled from 19 studies published between 1970 and 2007. Cigarette initiation during early adolescence has been investigated most often, as have familial-related, social learning constructs. Clear evidence was obtained for the age-specific effects of seven predictors: poor school performance, step-parent family, peer pro-cigarette norms, depression, low cigarette refusal self-efficacy, and frequent alcohol use. Suggestions for future research are indicated.
Keywords: predictors; cigarette initiation; inclusion criteria; standardized analytic techniques

INTRODUCTION

Cigarette smoking by people of all ages is an issue that warrants monitoring; however, smoking among youth should be approached with considerably more concern. Although a statistically normative behavior, the initiation and use of cigarettes during adolescence can carry high human costs. The human brain, which generally reaches maturity when individuals reach their 20s (Giedd, 2004), still is developing throughout the teen years. Adolescents who continue smoking cigarettes not only are exposed to toxic chemicals at a time in which their brains are growing, but patterned use can lead to homeostasis and nicotine tolerance at a relatively early age (Belluzi, Wang, & Leslie, 2005). These physiological processes taking place in the developing brain subject adolescents to significant risk for nicotine addiction, particularly long-term dependence that extends into the adult years, and elevated risks for cardiovascular diseases, cancer, respiratory diseases, and premature death (National Institute on Drug Abuse, 2009; U.S. Department of Health and Human Services, 2004). Among adults, smokers die 14 years earlier, on average, than nonsmokers (Centers for Disease Control and Prevention, 2008).

Perhaps one of the major reasons why the health consequences of smoking continue to pose a major

[1] Ph.D., Assistant Professor, University of Alabama, USA. Department of Criminal Justice, 416 Farrah Hall, Box 870320. Email: rjhowell@ua.edu.
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concern is because cigarettes remain one of the drugs of choice among youth, despite the recent increase in juvenile rates of prescription drug use (Johnston, O'Malley, Bachman, & Schulenberg, 2008). Cigarette incident rates have declined in recent years; however, these downturns are not as large as that observed for other delinquent acts, and current cigarette initiation levels are still very high compared to those observed in the early 1990s (Johnston et al., 2006). Today, nearly 50% of high-school seniors have initiated cigarette use (Johnston et al., 2009). Recent estimates of initiation among early adolescents are particularly troubling. Nearly 50% of 12-13 year olds who self-report smoking indicate initiating by 12 years of age or younger (Office of Applied Studies, 2005).

In response to this public health concern, and out of a need to maintain effective smoking prevention initiatives (Hawkins, Catalano, & Miller, 1992), researchers have directed a great deal of attention toward identifying the causes and correlates of cigarette initiation, while simultaneously assessing the utility of theory for specifying the types of explanatory factors and the processes by which attendant impacts occur. The wide support that major theories of adolescent drug use have engendered, particularly social learning theory (Akers, 1977), social bond theory (Hirschi, 1969) and the social development model (Catalano & Hawkins, 1996), have led, in part, to the advent of age-tailored youth drug prevention programs (Hawkins, Catalano, & Arthur, 2002).

Although still in its infancy, this translation of etiological research to prevention practice marked a significant change in the way researchers, drug prevention specialists, and school administrators traditionally approached the prevention of youth drug use. Traditionally, standard drug prevention programs were administered to all youth, regardless of age and attendant social and psychological development, or degree of involvement in drug use (Hawkins et al., 1992). Today, more and more school districts are making a concerted effort to tailor universal (primary), selective (secondary), and indicated (tertiary) programs such that content works to reduce and enhance the malleable risk and protective factors to which target participants, who are relatively homogenous in age, are exposed (Hawkins et al., 1992). This transition from blanket "one size fits all" prevention initiatives to age-specific, developmentally appropriate drug preventions has been slow-going; however, the etiological knowledge base on age-specific predictors of cigarette initiation has expanded, thereby prompting the need for comprehensive reviews that synthesize what is currently known and unknown about age differences in risk and protective factors (Derzon & Lipsey, 1999).

EXTANT REVIEWS OF THE LITERATURE

Setting delimits for 1970-2006, an electronic search of major social science databases was conducted, in an effort to retrieve past reviews that focused squarely on predictors of cigarette initiation and identify attendant voids that are worthy of redress. This search led to the identification of six reviews (Bauman & Ennett, 1996; Charlesworth & Glantz, 2005; Conrad, Flay, & Hill, 1992; Derzon & Lipsey, 1999; DiFranza et al., 2006; Wakefield, Flay, Nichter, & Giovino, 2003), which were subsequently assessed in terms of methodological rigor, focus, and level of comprehensiveness.

Four (Charlesworth & Glantz, 2005; Conrad et al., 1992; Derzon & Lipsey, 1999; DiFranza et al., 2006) of the six reviews used the systematic method of appraisal. In contrast to traditional, discursive reviews, systematic reviews (when conducted properly) "provide the most reliable and comprehensive statement about what works" (Petrosino, Boruch, Soyden, Duggan, & Sanchez-Meca, 2001, p. 20), and largely because the latter uses a rigorous and standardized method of identifying, appraising, and synthesizing a body of research (Cook & Leviton, 1980; Farrington & Welsh, 2001; Welsh & Farrington, 2006). Discussed are the research questions used in framing the assessment and the methodology that is employed, including inclusion or exclusion criteria. Traditional narrative and systematic reviews also differ in the structure and detail of the final report. Using the latter method, the reader is provided with a clear understanding of each stage of the research process, including how and why decisions were made and particular conclusions were drawn (Farrington & Welsh, 2001). One commonly used technique for organizing and presenting systematic findings, matrix-building, is particularly appealing, since its' use enables common or inconsistent findings to be more readily identified (Petraitis Flay, Miller, Torpy &

Greiner, 1998).

Only one (Conrad et al., 1992) review attempted to determine whether risk and protective factors for cigarette initiation differ by age. Conrad and colleagues' assessment of 27 longitudinal studies is more than 15 years old, however, and the goal of their research was not to provide an overt assessment of age-specific effects. Supplementary attention was directed at unearthing age-specific findings found within individual studies, as opposed to explicitly investigating age differences in predictors of cigarette initiation both within and across studies. Unfortunately, since few of the studies that they reviewed investigated age differences in risk and protective factors, Conrad et al. (1992) were unable to identify with confidence any substantive age patterns. In contrast to their work, the current study takes an explicit approach to identifying age-specific differences in risk and protective factors for cigarette initiation among youth, by comparing extant findings across studies and organizing the results according to six distinct stages of adolescent development.

The bulk of the reviews also did not appraise or report on risk or protective factors that originate from the five major domains of influence: community, school, family, peers, and adolescents, themselves (Hawkins et al., 1992). Conrad and colleagues' (1992) review constitutes the sole study that assessed predictors from all five of these domains.

In an effort to bridge these literature gaps, the current study used the systematic review method in providing a comprehensive appraisal of age-specific risk and protective factors for cigarette initiation among American adolescents. The review is unique, in that it constitutes the first known overt attempt to determine whether predictors of cigarette initiation among youth are age-graded, in that they differ as a function of age, or stage of adolescent development, as operationalized here. Two basic research questions guided the effort: (1) *What factors predict cigarette initiation among adolescents?* (2) *Are factors age-specific, in that they differentially predict cigarette initiation among youth at different stages of adolescence?*

METHOD

Inclusion Criteria

Table 1 details the inclusion criteria that were utilized in identifying primary study candidates for the systematic review. In particular, data were drawn from longitudinal and cross-sectional studies conducted in the U.S. and published in refereed sources (in English) between 1970 and 2007. Non-U.S. research was excluded based on the generally accepted assumption that social structure, economic forces, and social tolerance of drug use differ as a function of the culture endemic to particular countries (Brook, Brook, Arencibia-Mireles, Richter, & Whiteman, 2001; Patrick, 1970).

Eligible primary studies included those that utilized adolescent samples drawn from the general adolescent population who were not participating in drug prevention programs, and who were between the ages of 12 and 17 years when the criterion variables were measured. In cases where grade-level was employed as a proxy measure of age, and the age of study participants was not reported, studies were included if criterion variables were measured when youths were in 6^{th}-12^{th} grade. General population youth are those who, if targeted for drug prevention programming, would be provided universal (primary) prevention designed to reduce the risk for initiating drug use. The magnitude of risk effects generally are larger in studies utilizing selective (i.e., secondary) samples, compared to studies utilizing universal samples of youth who are at "normal" risk for initiation (Gorman, 1996; Norman & Turner, 1993).

For consistency, the primary studies included in the appraisal are those that focused upon the adolescent transition from lifetime abstention (never used) to lifetime initiation (ever used) of cigarettes. Studies defining initiation on the basis of questions about cigarette use in the past year, past month, or past week or few days were excluded (e.g., Cohen, Richardson, & LaBree, 1994; Ennett et al., 2006; Killen et al,. 1997; Yu & Williford, 1992). This is because it is likely that some of those youth considered abstainers actually were initiates who simply had not had the opportunity to smoke cigarettes within the narrower timeframes that were specified. Taking this criterion into account, eligible for inclusion were

cross-sectional studies that compared abstainers and initiates on a variety of psychosocial variables, or longitudinal studies that followed youth over time and compared psychosocial variables for adolescents who transitioned to initiation from abstention (at baseline) to youth who remained abstainers throughout the follow-up periods. To maintain consistency, research that examined gender-specific (e.g., Andrews, Hops, Ary, Lichenstein, & Tildesley, 1991; Killen et al., 1997; van den Bree, Whitmer, & Pickworth, 2004) and race-specific (e.g., Griesler & Kandel, 1998; Wallace, Brown, Bachman, & LaVeist, 2003) determinants of cigarette initiation were excluded.

Table 1: Inclusion Criteria

Study Component	Inclusion Criteria
Time period:	1970 - 2007
Publication and study type:	U.S. studies published in refereed sources
Language:	English
Study design:	Longitudinal; cross-sectional
Population characteristics:	Adolescents 12-17 years of age (6^{th}-12^{th} grade) at time of outcome measurement who are eligible for primary prevention programming, if targeted
Type of Predictors:	Risk and protective factors from individual, peer, family, school, and community domains of influence
Type of Outcome Measures:	Initiation of cigarettes
Timing of Measurement:	Criterion variables measured when study participants were 12-17 years of age
Analytic techniques:	Multivariate statistical techniques

Given the nature of the unique characteristics of prospective data, additional inclusion standards were applied to longitudinal studies. Eligible for inclusion were those that measured predictors at baseline and measured lifetime initiation at each wave of data collection. Studies that merely predicted Time 2 cigarette use status from Time 1 predictors without excluding Time 1 initiates were excluded from the review, because these studies included both Time 1 abstainers and initiates.

Finally, only studies that employed multivariate statistical techniques (e.g., regression, structural equation modeling, and discriminant function analysis) were eligible for inclusion. Excluded was research employing univariate and bivariate (correlational) techniques only and studies that only assessed group membership (such as through Analysis of Variance).

Study Retrieval

Standardized procedures commonly recommended for identifying potential study candidates were followed (see, e.g., Cook & Leviton, 1980; Cooper, 1982; Farrington & Weisburd, 2007). Multiple comprehensive searches were performed for the dual purpose of locating and including as many relevant published studies as possible and reducing the chance that data supporting a particular conclusion would be preferentially identified while other published findings would be missed. Keyword searches of studies published in books and journals indexed in electronic databases and organization websites all were examined. The following electronic databases were searched: Academic Search Premier, CINAHL Select and Full Text, ERIC, Health Source- Consumer Edition and Nursing/Academic Edition, InfoTrac, JSTOR, MEDLINE, Primary Development Collection, PsycARTICLES, PsycINFO, Psychology/Behavioral Sciences Collection, PubMed, SocINDEX with Full Text, and Sociological Collection. A search of four organization websites also was conducted, including: Drug Policy Alliance, JTO Direct Archive, National Clearinghouse for Alcohol and Drug Information, and the Society for Prevention Research.

Each study abstract was assessed to determine whether the full study was suitable for retrieval. After full copies of the studies were retrieved, a more detailed assessment of each was conducted in order to determine whether the inclusion criteria were fully met. The literature review portion of each study then was read, and bibliographic scans were conducted in an attempt to locate additional studies. These methods identified 24 statistical models found in 19 primary studies (see Appendix) that met the inclusion criteria. The majority (n = 18) of the models utilized longitudinal data.

Analytic Approach

Analyses consisted of three major stages, several of which were preparatory in nature. Overall, the stages included documenting study characteristics; recording significant relationships; and organizing individual findings and synthesizing results, identifying similarities and dissimilarities in findings, and drawing conclusions.

Inconsistent findings across studies can sometimes be explained by differences in subjects, sample sizes, sampling error, setting, the quality of research methods, and the nature of other variables that were controlled (Feldman, 1971; Jackson, 1980). In an attempt to explain divergent findings across studies, as well as contextualize the results, 17 major study characteristics first were culled from each primary study and systematically documented. These study features include the following: study design; sample size; geographic location of sample; location of data collection; data source; whether a probability sampling method was utilized; whether efforts were undertaken to reduce under- and over-reporting; whether the findings were cross-validated; the age (or grade-level) that predictor and outcome variables were measured; how the outcome variable was operationalized; the type of predictors and associated ecological domains; whether mediation or moderation effects were investigated; the multivariate analytic technique employed; and major study limitations.

Final prediction models (after all independent variables have been entered) in each study then were assessed in order to identify and document the direction (+/-) and significance

($p \leq .05$) of each coefficient (for each predictor-outcome relationship). A total of 200 directional effects were identified and documented. Following the lead of Light and Smith (1971, p. 433), three specific outcomes were defined in relation to $p \leq .05$: 1) positive (+) significant relationships; 2) negative (-) significant relationships; and 3) non-significant relationships (+/-). Primary studies used different statistical analysis techniques, and standardized coefficients were not reported for each predictor examined across studies, so a comparison of the strength of relationships was not assessed.

Multiple matrices were used to organize relationships and provide a systematic means by which similar and conflicting findings across studies could be identified. To account for the fact that numerous studies obtained data from samples of youth whose biological ages (or grade-levels) spanned more than one conventional period of adolescence (i.e., early adolescence), findings were organized according to six specific age groups: early-late adolescence (12-17 years, or 6^{th}-12^{th} grade), early adolescence (12-14 years, or 6^{th}-8^{th} grade), early-mid adolescence (12-16 years, or 6^{th}-10^{th} grade), mid-adolescence (14-16 years, or 9^{th}-10^{th} grade), mid-late adolescence (14-17 years, or 9^{th}-12^{th} grade), and late adolescence (16-17 years, or 11^{th}-12^{th} grade). Age group classifications for early, mid-, and late adolescence are similar to those used by other drug researchers (see, e.g., D'Amico et al., 2005; Scheier, Newcomb, & Skager, 1994).

Within each period of adolescent development, findings then were organized by the ecological domain from which predictors originate (i.e., individual, peer, family, school, community) and the type of factor (e.g., social learning construct) found within each ecological domain. To reinforce this organizational scheme and aid in synthesizing findings, EndNote, version 8.0 (Thompson ISI ResearchSoft, 2004) was used. Keywords were used to link individual primary studies by study design, stage of adolescent development, ecological domain, general theoretical construct, and results.

Finally, the directional (+/-) findings from individual primary studies were synthesized, with common and conflicting directional effects identified. In an effort to report the direction of effects for each predictor, while facilitating comparisons, the tabular results (presented below) were organized according to the five ecological domains of influence. Similar to Petraitis and colleagues' (1998) systematic review

of youth marijuana use, each primary study was assigned a reference number. These numbers, which range from 1-19, link individual directional findings reported in the tables below with attendant study (i.e., author and publication year) information, which is documented in the Appendix.

RESULTS

Descriptive Characteristics

To provide some context for the review, the sampling characteristics, methodological features, and limitations of each of the 19 studies were culled and compared, with attention paid to commonalities. With respect to sampling, the bulk of the primary studies collected data from school district-wide samples (63%) of students in classroom settings (74%). On average, samples tended to be strictly comprised of urban youth (42%), or juveniles from varying geographic locations (42%). Only one study (Skinner, Massey, Krohn, & Lauer, 1985) collected data from rural adolescent youth.

The findings reported below are organized by the ages of respective samples. Seven prediction models centered on cigarette initiation among early adolescents, while the second most common age group investigated included samples of youth whose ages spanned early-late adolescence. Four models each investigated cigarette initiation among mid-adolescents and mid-late adolescent youth, while two models investigated initiation among early-mid adolescents. Only one model examined initiation among late adolescent youth.

Several common methodological features were identified. The majority (75%) of the models were developed with longitudinal data, while nearly all (95%) studies obtained data using the self-report survey method. On average, no overt strides were taken to reduce under- or over-reporting, although five studies (Chassin et al., 1984; Chassin et al., 1986; Foshee & Bauman, 1992; Gritz et al., 2003; Skinner et al., 1985) took advantage of a CO or saliva pipeline, while two projects (D'Amico & McCarthy, 2006; Duncan et al., 1998) issued respondents' a Certificate of Confidentiality. Chassin and colleagues (Chassin et al., 1984; Chassin et al. 1986) were the only researchers to cross-validate their results to findings derived from similar samples.

By far, binary logistic regression (63%) constituted the most commonly used analytic technique. Discriminant function analysis was utilized in two studies (Chassin et al., 1984; Skinner et al., 1985), while individual studies employed structural equation modeling (Flay et al., 1994), multinomial logistic regression (Flay et al., 1998), latent growth modeling (Duncan et al., 1998), and hierarchical linear modeling (Pokorny et al., 2003).

Four major study limitations were identified. First, the majority (74%) of the primary studies confined analyses to a limited number of ecological domains and predictors. To illustrate, Flewelling and Bauman (1990) assessed the impact of family structure variables (e.g., single- and step-parent family structure) on cigarette initiation among youth during early and mid-adolescence. Although several controls were employed, these researchers did not examine predictors from other ecological domains (e.g., community, school, peer, or individual).

Second, 63% of the primary studies suffered from some degree of attrition, low participation, missing data, or the inability to match respondents across longitudinal waves (e.g., D'Amico & McCarthy, 2006; Flay et al., 1998; Flewelling & Bauman, 1990; Foshee & Bauman, 1992; Tilson et al., 2004). As the most extreme example, 50% of Flay et al.'s (1998) sample initially recruited at T1 dropped out of the study by T2.

Third, judging from the information that was included in the published reports, the findings from 37% (n = 7) of the studies appear to be limited to the specific sample populations from which data were derived. For instance, several researchers (see, e.g., Flewelling & Bauman, 1990; Foshee & Bauman, 1992; Kandel et al., 2004; Pokorny et al., 2003; Skinner et al., 1985) did not report the demographic make-up of the samples upon which their findings were based. Moreover, of the researchers who did report on the racial distribution of respective samples, several studies obtained data from predominantly

white (e.g., Duncan et al., 1998) or black (e.g., Tilson et al., 2004) youth.

Fourth, although the social sciences typically regard significant associations as more informative and of higher practical value than insignificant relationships (Kachigan, 1986), publication standards established by the American Psychological Association recommend that researchers report the directional effects exerted by variables not meeting typical significance thresholds (i.e., $p < .05$, $p < .01$; see Morgan, Reichert, & Harrison, 2002). Aside from this technical reporting requirement, making known the direction of insignificant relationships has the potential to inform and advance knowledge on both etiology and prevention fronts, by furthering an understanding of how constructs operate (i.e., increase or decrease risk) and what theoretical explanations yield the most empirical support. Tempering the strides that were taken to summarize the nature of all of the non-significant findings, five studies (Chassin et al., 1984; Gritz et al., 2003; Pokorny et al., 2003; Urberg et al., 2003; Walter et al., 1991) did not report the direction of insignificant effects. These tabularized findings are notated with a question mark (?).

Community Domain Predictors

Table 2: Community and School Domain Predictors: Directional Effects by Stage of Adolescent Development

Predictors	$p<.05$ (+/-)	$p>.05$ (+/-)
	Community Domain	
Social Learning Constructs:		
Non-familial adult cigarette use	2b(+, M-L); 2c(+, E-L)	2a(?, E)
Pro-tobacco messages		11(+, E-L)
Exposure to smoking in media	2a(+, E)	
Tolerant cigarette media messages/depictions		2c(?, E-L)
Community Characteristics:		
Cigarette availability	14(+, E)	
Rate of tobacco retailers		13(?, E)
Prohibition of cigarette vending machines	12(-, E-L)	
Prohibition of tobacco marketing	12(+, E-L)	
Low cigarette sales tax	12(+, E-L)	
	School Domain	
Bonding Constructs:		
Poor school performance	14(+, E)	7(+, L); 11(?, E-L)
Low school commitment	2a,c(+, E, E-L)	18(?, E-L)
High school commitment	2b(-, M-L); 10(-, M-L); 15a,c(-, M-L)	15b (-, M)
High school attachment	12(-, E-L)	
Behavioral Constructs:		
Absenteeism/truancy		19(?, M)
Detention/suspension	11(+, E-L)	19(?, M)
% students smoke	12(+, E-L)	
School Characteristics:		
% minority		12(?, E-L)
Strict smoking policy		12(+, E-L)

[a] E-L = Early-Late Adolescence; E = Early Adolescence; M = Mid-Adolescence; M-L = Mid-Late Adolescence,

L = Late Adolescence.

Presented in Table 2, five primary studies examined the efficacy of nine community domain predictors of cigarette initiation. The majority of the findings stemmed from data derived from early-late adolescent youth. Since none of the primary studies examined the utility of community influences for predicting cigarette initiation among distinct samples of mid-, late, or early-mid adolescent youth, the age-specific impact of variables was unable to be assessed. Of the community factors that were investigated, constructs associated with Akers' social learning theory (1977) were the most frequently evaluated, particularly non-familial adult cigarette use. Surprisingly, none of the findings speak to the impact of community bonding constructs. Due to the paucity of research and the unknown direction of insignificant findings, it is unclear whether tolerant media depictions of cigarettes (Chassin et al., 1986) and the existence of tobacco retailers (Pokorny et al., 2003) in a community function in a risk or protective fashion.

Full convergence. Full support was obtained for the directional findings of the sole predictor that was examined for several periods of adolescence. Non-familial adult cigarette use increased risk for initiation during early-late and mid-late adolescence (Chassin et al., 1984).

The risk effects exerted by one variable countered theoretical and intuitive expectations. Kandel et al.'s (2004) longitudinal study found that among their probability sample of 5,347 early-late adolescent youth who resided in rural, urban, and suburban areas, youth who lived in communities in which tobacco marketing was prohibited were at a greater risk for cigarette initiation than adolescents who resided in communities that did not enact such a ban. This is an interesting finding, particularly given the fact that the official data used in developing this extraneous variable were collected prior to the cigarette initiation data. In line with MacCoun and Reuter's (2001) notion of the "forbidden fruit" effect that drug law mechanisms constitute, it is possible that adolescents' knowledge of the marketing ban, coupled with their knowledge of cigarette use as a non-delinquency status offense, may have inadvertently elicited the obtained risk effect. These researchers did not assess the sample's knowledge of a tobacco marketing ban, so it is unclear how likely this "forbidden fruit" effect may have been operating.

School Domain Predictors

Table 2 also details the findings for 18 measures of nine school-related factors. Of the influences that were investigated, bonding constructs received the most attention, while school-related behavior and school characteristics were studied the least. No investigations of school predictors of cigarette initiation during early-mid adolescence were conducted, while only one model (Flay et al., 1998) assessed onset during late adolescence. The sole studies (Walter et al., 1991) that investigated the predictive utility of absenteeism/truancy (Walter et al., 1991) and school racial composition (Kandel et al., 2004) did not report the direction of the insignificant effects that were obtained.

Across stages of development, consistent directional findings were found for one risk factor and one protective factor. Poor school performance has been found to increase risk for cigarette initiation during both early (Robinson et al., 1997) and late (Flay et al., 1998) adolescence. However, the finding for initiation during late adolescence was insignificant, thereby providing some evidence that this factor exerts age-specific effects. With respect to protection, the five findings from three longitudinal studies (Chassin et al., 1984; Foshee & Bauman, 1992; Skinner et al., 1985) indict high school commitment as a salient protective factor among mid-late adolescent youth. Bolstering this set of findings are the results reported by Chassin et al. (1984) for low school commitment, a factor that increased initiation risk among early adolescent youth and a sample of juveniles whose ages spanned adolescence.

Family Domain Predictors

Three thematic findings emerged from the directional effects posed by 68 measures of 26 family domain variables (see Table 3). First, the importance of family factors has been studied with samples of youth

from all major periods of adolescence. However, Flay et al.'s (1998) longitudinal study constituted the only investigation of cigarette initiation during late adolescence, and Ennett and colleagues (2001) were the only researchers to determine the utility of family constructs for predicting initiation among early-mid adolescents.

Table 3: Family Domain Predictors: Directional Effects by Stage of Adolescent Development [a]

Predictors	$p<.05$ (+/-)	$p>.05$ (+/-)
Social Learning Constructs:		
Parental alcohol use		6(-, E-M)
Parental cigarette use	2a,c(+, E, E-L); 3(+, E-L); 6(+, E-M); 7(+, L)	2b(?, M-L); 12(+, E-L); 13(+, E); 14(+, E)
Maternal cigarette use		10(-, M-L); 15a,c(-, M-L); 15b (-, M)
Paternal cigarette use		10(+, M-L); 15a,c(+, M-L); 15b(+, M)
Older sibling cigarette use	2a,c(+, E, E-L)	2b(?, M-L)
Household smoker	11(+, E-L)	
Parental pro-cigarette norms		3(+, E-L); 7(+, L); 11(?, E-L)
Parental pro-drug norms		6(-, E-M)
Social Bonding Constructs:		
Maternal Attachment	10(-, M-L); 15a,c(-, M-L)	15b(-, M)
Paternal Attachment	10(-, M-L); 15a,c(+, M-L)	15b(+, M)
Value spending time w/ parents		18(?, E-L)
Relationship Constructs:		
Little clarity of family rules	2c(+, E-L)	
Clear rules about legal drug use		6(+, E-M)
Parental consistency in expectations		2b(?, M-L)
Low family conflict		7(-, L)
Low parental support	19(+, M)	
Parental prosocial support		2a,c(?, E, E-L); 2b(?, M-L); 3(-, E-L); 6(-, E-M)
Good communication—media portrayals & consequences of legal drug use		6(-, E-M)
Parental strictness		2b(?, E-L); 2c(?, M-L); 3(+, E-L)
Good parent-child relationship	1(-, E-L)	18(-, E-L)
Good relationship with mother		18(?, E-L)
High parental monitoring		1(+, E-L); 6(+, E-M); 15a,b(-, M, M-L); 15c(+, M-L); 18(?, E-L)
Family Characteristics:		
Divorce	1(+, E-L)	
Step-parent family	9b(+, E)	1(+, E-L); 9a(+, M)
Single-parent family	1(+, E-L); 9a,b(+, M, E);	

	12(+, E-L); 16(+, E)
Two-parent family	6(-, E-M)

[a] E-L = Early-Late Adolescence; E = Early Adolescence; M = Mid-Adolescence; M-L = Mid-Late Adolescence, L = Late Adolescence.

Second, parents and siblings constitute role models and influential agents who predominantly influence the drug behavior of youth by modeling the use of drugs, transmitting norms concerning the acceptability of use, providing access, and, in some instances, exerting overt pressure to initiate (Donovan, 2004). As this review revealed, Akers' (1977) social learning constructs of parental smoking and attendant norms constitute some of the more widely investigated familial influences, particularly parental cigarette use. With respect to sibling influence, cigarette use is the only mechanism to which prior research has directed attention, although this social learning construct was investigated far less frequently than parental smoking.

The interesting findings for parental cigarette use and attachment are worth noting. Multiple results (Foshee & Bauman, 1990; Skinner et al., 1985) suggest that although the impact of maternal cigarette use alone or paternal cigarette use alone is not considerable, the combined effects of maternal and paternal cigarette use (as measured by parental cigarette use) does place youth at considerable risk for smoking onset (Amey & Albrecht, 1998; Chassin et al., 1984; Ennett et al., 2001; Flay et al., 1998; Kandel et al., 2004; Pokorny et al., 2003; Robinson et al., 1997). Also, although maternal and paternal cigarette use were not important determinants of onset, and maternal and paternal attachment were, the attendant directional effects of these four predictors tended to vary along gender lines. Maternal cigarette use and maternal attachment were found to operate in a protective fashion, while paternal cigarette use and the youth attachment to fathers tend to increase risk for initiation (Foshee & Bauman, 1990; Skinner et al., 1985).

Finally, the efficacy of relationship constructs, particularly parental monitoring, has received far more attention than the utility of social bonding factors. Of the bonding constructs that were assessed, parental attachment was the most widely investigated.

Full convergence. Almost 80% (n = 15) of the primary studies assessed the utility of one or more familial determinants. Putting aside level of significance, of those predictors for which multiple investigations were conducted, the directional findings for 10 factors fully converged. Consistent findings were yielded for six family risk factors: parental and older sibling cigarette use, paternal cigarette use, parental pro-cigarette norms, and step-parent and single-parent family structure. The consistent, significant findings for single-parent family structure across adolescence provide evidence that this factor exerts important age-invariant effects.

Multiple findings also suggest that four variables exert important protective effects. These include maternal attachment (Foshee & Bauman, 1992; Skinner et al., 1985), maternal cigarette use (Foshee & Bauman, 1992; Skinner et al., 1985), parental prosocial support (Chassin et al., 1984; Chassin et al., 1986; Ennett et al., 2001), and a good parent-child relationship (Amey & Albrecht, 1998; Kandel et al., 2004).

Age-specific findings. The directional effects posed by paternal attachment, step-parent family structure, and high parental monitoring were found to differ by age. Skinner and colleagues (1985) found that paternal attachment increased risk for cigarette initiation among two samples of mid-late adolescent youth and one separate sample of mid-adolescent youth. Since this latter finding was not significant at the .05 level, the salience of paternal attachment appears to differ by developmental period of adolescence. What complicates this set of findings, however, is that Foshee and Bauman's (1992) longitudinal study found that this predictor operates in a protective fashion, by decreasing risk for smoking onset among mid-late adolescent youth. Clarification on the direction and importance of these effects is needed.

Compared to juveniles who live with both biological parents, youth who reside in step-parent families appear to be at a substantially higher risk for initiating smoking at an early age (Flewelling & Bauman, 1990). In contrast, however, whether youth live in step-parent or two-parent families appears to have no considerable bearing on the odds of cigarette initiation during late adolescence (Flewelling & Bauman,

1990). The latter finding also was obtained by Amey and Albrecht (1998) with a sample of youth whose ages ranged from early-late adolescence.

Three (Amey & Albrecht, 1998; Ennett et al., 2001; Skinner et al., 1985) investigations assessed the utility of high parental monitoring and reported the direction of the relationships obtained. All of the results were insignificant, thereby providing evidence that this construct does not make an important contribution to explaining cigarette initiation among youth. Nonetheless, high parental monitoring was found in two of Skinner et al.'s (1985) models to decrease risk for initiation during mid- and mid-late adolescence. It appears that a possible non-significant interaction between age and high levels of parental monitoring may exist, but the evidence is a bit convoluted to clearly support this contention.

Peer Domain Predictors

Table 4 presents the relationships between cigarette initiation and 50 measures of 19 peer-related variables. A number of general thematic findings were obtained. Peer constructs consistent with Akers' (1977) social learning theory and the social development model (Catalano & Hawkins, 1996) were assessed more frequently than the elements of Hirschi's (1969) social bond theory. In fact, only two studies (Skinner et al., 1985; Urberg et al., 2003) examined measures of peer bonding, both of which centered on peer attachment. Of the peer domain factors that were evaluated, the social learning construct of peer smoking was the most frequently investigated and among the most empirically supported predictors identified in this review, a finding that is both consistent with that obtained by Conrad and colleagues (1992) and supportive of the social development model (Catalano & Hawkins, 1996). Researchers have directed little attention, however, to peer-related social learning variables that center on the use of drugs (and associated norms) such as alcohol, marijuana, or hard drugs.

Table 4: Peer Domain Predictors: Directional Effects by Stage of Adolescent Development [a]

Predictors	$p<.05$ (+/-)	$p>.05$ (+/-)
Social Learning Constructs:		
Peer cigarette use	3(+, E-L); 8(+, E); 10(+, M-L); 11(+, E-L); 12(+, E-L); 13(+, E); 14(+, E); 18(+, E-L); 19(+, M)	4(+, E); 7(+, L)
Same grade cigarette using peers		19(?, M)
Best friend cigarette use	2b(+, E-L); 2c(+, M-L)	2a(?, E)
Number of smoking friends	7(+, L)	
Male peer cigarette use	2a,c(+, E, E-L)	2b(?, M-L)
Female peer cigarette use	2a,c(+, E, E-L)	2b(?, M-L)
Peer marijuana use		4(-, E)
Close friend drug use	17(+, E-M)	
Friendship group drug use		17(+, E-M)
Peer pro-cigarette norms	19(+, M)	3(+, E-L); 7(+, L); 11(?, E-L)
Association with male smoking peers		15a,c(+, M-L); 15b(+, M)
Association with female smoking peers		15a,c(+, M-L); 15b(-, M)
Social Bonding Constructs:		
Attachment to peers	15a(+, M-L)	15b(+, M); 15c(+, M-L)
Strong friendship	18(+, E-L)	
Relationship Constructs:		
Peer conflict		18(?, E-L)
Peer strictness		3(?, E-L)
Peer support		2a,c(?, E, E-L); 2b(?, M-L);

		3(?, E-L); 18(?, E-L)
Consistency in peer-youth prosocial values	2b(-, E-L); 2c(-, M-L)	2a(?, E)
Peer high academic expectations for youth	3(-, E-L)	

[a] E-L = Early-Late Adolescence; E = Early Adolescence; E-M = Early-Mid Adolescence; M = Mid-Adolescence; M-L = Mid-Late Adolescence; L = Late Adolescence.

In general, more attention also has been directed at peer-related determinants of cigarette onset during early adolescence than mid- (Urberg et al., 1997) or late (Flay et al., 1998) adolescence, although the most common investigations have been based upon samples of youth whose ages span the entire period of adolescence. Peer conflict (Urberg et al., 2003), strictness (Chassin et al., 1986), and support (Chassin et al., 1984; Chassin et al., 1986; Urberg et al., 2003) appear to be unimportant determinants, but more research is warranted given the too few tests that have been conducted and the lack of clarity on the directional impacts.

Full convergence. Irrespective of alpha level, of those predictors for which multiple investigations were conducted, the directional effects exerted by six factors not only fully converged, but they met the expectations of social learning theory (Akers, 1977) and the social development model (Catalano & Hawkins, 1996). Consistent directional findings were yielded for the following constructs, all of which evidenced risk capacities: peer cigarette use (including best friends' use and male and female peer use), which was a significant predictor for onset during all but one (late adolescence) stage of development; peer pro-cigarette norms; and association with male smoking peers. The directional effects of attachment to peers also converged, although the nature of these relationships counter Hirschi's (1969) social bonding proposition concerning the association between attachment and delinquency abstention. Instead of reducing the likelihood of cigarette initiation, Skinner and colleagues (1985) found that attachment to peers increases risk.

The three findings from Chassin et al.'s (1984) longitudinal study provide some solid evidence for the protective capacity demonstrated by the homogeneity in adolescent-peer prosocial values. Among 7^{th}-8^{th}, 9^{th}-12^{th}, and 7^{th}-12^{th} grade students, youth whose prosocial values are consistent with those of their friends were less likely to initiate smoking.

Age-specific effects. Clear evidence for one age-specific, peer domain variable was obtained. Peers who condone cigarette use were found to place mid-adolescent youth at significant risk for smoking initiation (Walter et al., 1991). Comparatively, this construct did not make a significant contribution to explaining cigarette onset during late adolescence (Flay et al., 1998), or with samples of youth whose ages span the entire period of adolescence (Chassin et al., 1986).

The longitudinal findings for the impact that associating with female smoking peers has on youth cigarette onset suggest that although this predictor is not an important determinant, the directional effects may vary as a function of age. This factor decreased risk for onset among a sample of mid-adolescent youth, but increased the odds of cigarette initiation among two samples of youth whose ages spanned mid-late adolescence (Skinner et al., 1985).

Individual Domain Predictors

Table 5 details the directional effects posed by 23 individual domain predictors. Cigarette initiation among mid-adolescent youth was most commonly investigated, while none of the primary studies examined the utility of individual domain variables for predicting onset among youth whose ages spanned mid-late adolescence. Flay et al.'s (1998) longitudinal study constituted the sole investigation of individual predictors of initiation during late adolescence.

In general, adolescents' personal attitudes and intentions were the most widely researched predictors, particularly the effects posed by cigarette use intentions (Chassin et al., 1984; Flay et al., 1994; Gritz et al., 2003). Five variables (i.e., anxiety, low self-esteem, pro-cigarette norms, the belief that alcohol and cigarette use are harmful, and stressful life events) were found by individual studies to exert unimportant effects on cigarette initiation. Due to the failure to report the direction of these impacts, the nature of respective effects is unknown.

Full convergence. Taking together the significant and insignificant findings from multiple models, past research has indicted eight predictors as increasing risk for cigarette initiation. These factors include sensation-seeking (Robinson et al. 1997; Urberg et al., 2003); low locus of control (Chassin et al., 1984); cigarette use intentions (Chassin et al., 1984; Flay et al., 1994; Gritz et al., 2003); tolerance of deviance (Chassin et al., 1984); belief in the appropriate use of alcohol and cigarettes (Skinner et al. ,1985); frequent alcohol use (D'Amico & McCarthy, 2006; Flay et al., 1998); frequent marijuana use (D'Amico & McCarthy, 2006; Flay et al., 1998); and deviance/delinquency (D'Amico & McCarthy, 2006; Flay et al., 1998). Of these variables, three (low locus of control, cigarette use intentions, and tolerance of deviance) constituted significant, universal risk factors, in that they predicted cigarette initiation during all periods of adolescence.

Age-specific effects. Both significant and non-significant age differences in predictors were identified. Three factors were found to pose significant, age-specific effects: frequent alcohol use, low cigarette refusal self-efficacy, and depression. The findings from three studies provide some evidence that although frequent alcohol use increases risk for initiation across adolescence, this risk may be more substantial for youth during early and late adolescence (D'Amico & McCarthy, 2005; Flay et al., 1998), as opposed to onset that occurs during mid-adolescence (Duncan et al., 1998). Low cigarette refusal self-efficacy was found to be a salient risk factor for initiation during mid-adolescence (Walter et al., 1991), but not onset that occurs during late adolescence (Flay et al., 1998).

Table 5: Individual Domain Predictors: Directional Effects by Stage of Adolescent Development [a]

Predictors	$p<.05$ (+/-)	$p>.05$ (+/-)
Traits/States:		
Sensation-seeking	14(+, E); 18(+, E-L)	
Risk-taking		7(-, L)
Depression	19(+, M)	11(?, E-L); 12(-, E-L)
Anxiety		19(?, M)
Low self-esteem		18(?, E-L)
Low locus of control	2a,c(+, E, E-L); 2b(+, M-L)	
Low cigarette refusal self-efficacy	19(+, M)	7(+, L)
Attitudes/Intentions:		
Cigarette use intention	2a,c(+, E, E-L); 2b(+, M-L); 8(+, E); 11(+, E-L)	
Pro-cigarette norms		19(?, M)
Tolerance of deviance	2a,c(+, E, E-L); 2b(+, M-L)	
Alcohol use as harmful		18(?, E-L)
Cigarette use as harmful		18(?, E-L)
Occasional cigarette use not risky	19(+, M)	
Belief- appropriate use of alcohol and cigarettes	15a,b(-, M-L, M)	15c(-, M-L)
Belief- appropriate use of drugs		15a,c(+, M-L); 15b(+, M)
High religiousness		15c(+, M-L); 15a,b(-,M-L, M)
Prosocial beliefs		2a,c(?, E, E-L); 2b(?, M-L); 15a,c(-, M-L); 15b(-, M)
Behavioral Constructs:		
Frequent alcohol use	4(+, E); 7(+, L)	5(+, M)
Increase in extent of alcohol use		5(+, M)
Frequent marijuana use	4(+, E); 7(+, L)	
Deviance/delinquency	4(+, E); 7(+, L)	
Work-for-pay		12(+, E-L); 15b(-, M); 15a,c(+, M-L)
Events:		
Stressful life events		19(?, M)

[a] E-L = Early-Late Adolescence; E = Early Adolescence; M = Mid-Adolescence; M-L = Mid-Late Adolescence; L = Late Adolescence.

The age-graded findings concerning depression point to the possibility of an age interaction effect, although further confirmation is needed. Kandel et al.'s (2004) longitudinal research found that youth of all ages who self-reported high levels were less likely to initiate cigarette use than their counterparts. In Walter et al.'s (1991) cross-sectional study, however, depression increased risk for onset during mid-adolescence. Although Kandel and colleagues' result was insignificant, the fact that their measure of depression was obtained prior to self-reported cigarette initiation suggests that their finding may have more credence.

Age differences in the directional effects posed by high religiousness and involvement in work-for-pay activities also were found, and underscore the possibility that age may moderate the impact of these factors, although the findings were not significant at the .05 alpha level. As for religiousness, Skinner et al. (1985) developed three longitudinal prediction models in assessing the impact that high levels of such has on the likelihood of cigarette initiation among junior and senior high students, junior-high students alone, and high-school students alone. Although insignificant, high levels of religiousness served as a protective factor for cigarette initiation among junior-high students and the combined sample, but increased risk for initiation among high-school students.

With respect to paid employment, the few investigations that were conducted indicate that whether an adolescent holds a paid job does not have a considerable impact on the probability of smoking onset. However, longitudinal work by both Kandel and associates (2004) and Skinner and colleagues (1985) revealed that frequent involvement in work-for-pay activities does increase (by an insignificant amount) risk for cigarette initiation among youth of all ages. In contrast, Skinner et al.'s (1985) finding for a sample composed of strictly junior-high students suggests that frequent paid employment may operate in an unimportant protective fashion.

DISCUSSION

This systematic appraisal of predictors of cigarette initiation among youth served to address two voids in the review literature. The directional effects posed by risk and protective factors originating from all five ecological domains influence were investigated, and an overt effort was made to determine the extent to which predictors exert age-specific effects. The findings inform both the etiological literature base and drug prevention programs that aim to prevent smoking initiation during adolescence.

The most frequently investigated constructs were those that coincide with social learning theory (Akers, 1977), social control theory (Hirschi, 1969), and (to a lesser extent) the social development model (Catalano & Hawkins, 1996). Two pieces of general evidence support the conclusion that, with few exceptions, the direction of relationships met the expectations that major theories of drug use have put forth. When considering only those 88 effects that were significant at the .05 alpha-level, 96% (n = 85) exerted risk or protective impacts consistent with theoretical expectations. The three counter findings centered on paternal attachment (a construct consistent with social bond theory) and the prohibition of cigarette vending machines. Further, irrespective of significance level, 82% (n = 129) of the 157 effects for which the direction of impacts were reported were in directions postulated by theory.

As with any single piece of research, the 19 primary studies included in the review suffered from some limitations; however, this body of research confirms the importance of many well-accepted predictors, while raising some questions about others. In general, expected relationships were strongly supported for (1) social learning variables, particularly peer cigarette use and most measures of family smoking; (2) social bonding variables, particularly peer and family bonding; and (3) individual domain variables, including cigarette-specific attitudes and intentions, low locus of control, and tolerance of deviance.

A few other overarching themes emerged from the review. Table 6 provides a break-down of the ecological domains and predictors that the 19 primary studies most frequently examined for each of the

six periods of adolescent development. Across age, the family domain constituted the most widely assessed ecological domain, while variables from the community domain were investigated the least often. In fact, nearly all (19/24) of the models examined included family-related predictors, and 34% (n = 68) of the 200 relationships presented in this review dealt with the impact of family domain variables. Across age and the five ecological domains, constructs rooted in social learning theory and the social development model (e.g., parental and peer drug use and drug-related norms) tended to be examined most often.

Organizing findings by ecological domain and stage of development also made it possible to identify what domains tended to be examined most and least often with respect to predicting smoking onset at different ages. By far, the most commonly investigated outcome was cigarette initiation among samples of youth whose ages spanned all periods of adolescence. This was true of all studies examining community, school, family, and peer domain predictors. In contrast, factors from the individual domain were appraised more often in predicting cigarette initiation during mid-adolescence than at any other stage. With respect to the least commonly researched periods of development, no studies investigated community domain determinants of cigarette initiation during mid-, late, and early-mid adolescence and family predictors of onset during late adolescence. Only one study examined school factors for initiation during late adolescence.

Table 6: Select Design, Domain, and Predictor Descriptives by Sample Population

Sample Population [a]	Design Type [b]	Ecological Domains, Number of Models Appraising [c]	Predictor Most Commonly Assessed
E-L Adolescence	L = 5, C = 1	C = 3, S = 4, F = 6, P = 5, I = 4	Parental Cigarette Use
E Adolescence	L = 3, C = 4	C = 3, S = 2, F = 5, P = 5, I = 4	Peer Cigarette Use
E-M Adolescence	L = 2	C = 0, S = 0, F = 1, P = 1, I = 0	(No One More Common)
M Adolescence	L = 2, C = 1	C = 0, S = 2, F = 2, P = 2, I = 3	Low School Commitment, Parental Attachment, Parental Cigarette Use, Association w/ Smoking Peers
M-L Adolescence	L = 3	C = 1, S = 3, F = 3, P = 3, I = 3	Peer Cigarette Use
L Adolescence	L = 2	C = 0, S = 2, F = 2, P = 2, I = 2	Parental Cigarette Use

[a] E-L Adolescence = 12-17 years, 6^{th}-12^{th} grade; E Adolescence = 12-14 years, 6^{th}-8^{th} grade; E-M Adolescence = 12-16 years, 6^{th}-10^{th} grade;
M Adolescence = 14-16 years, 9^{th}-10^{th} grade; M-L Adolescence = 14-18 years, 9^{th}-12^{th} grade; L Adolescence = 16-18 years, 11^{th}-12^{th} grade

[b] L = Longitudinal; C = Cross-Sectional

[c] C = Community Domain; S = School Domain; F = Family Domain; P = Peer Domain; I = Individual Domain

Age-Invariant and Age-Specific Predictors

The review identified two types of variables: age invariant and age-specific predictors. Age invariant (i.e., universal) predictors emerged upon examining the significant, directional effects posed by variables investigated in multiple studies with data from samples whose ages were distinctly different (e.g., early versus late adolescence), and, together, captured the major periods of adolescence. To identify age-specific predictors, both the directional impacts of significant and insignificant relationships were appraised. Discussed below, more evidence for age-specific differences (seven variables) in predictors was obtained than that which was yielded for age-invariant factors (four predictors).

Age-invariant predictors. Four variables constituted universal predictors of cigarette initiation among youth: single-parent family structure (versus two-parent family), low locus of control, cigarette use intentions, and tolerance of deviance. Regardless of the ages of the samples, these family and individual domain variables all served as risk factors for smoking onset. Because some of the findings were

insignificant, less clear evidence of age-invariant impacts was yielded for another three constructs: school commitment, parental cigarette use (based on combined measures of maternal and paternal smoking), and peer cigarette use (as demonstrated by multiple measures and variants of use).

Age-specific predictors. A number of findings were significant for one distinct age group, but not another, indicating that the associated variables exert age-specific effects. Seven peer and individual domain factors were found to pose age-graded impacts: poor school performance, step-parent family structure (versus two-parent family), paternal attachment, peer pro-cigarette norms, depression, low cigarette refusal self-efficacy, and frequent alcohol use. The most glaring differential age differences in initiation were those dealing with cigarette refusal self-efficacy and frequent alcohol use, although additional research should confirm this set of findings.

Four other predictors may interact with age in exerting age-specific effects, but since these findings were insignificant at the .05 alpha-level and overt tests of age-by-factor interactions were not conducted in the associated primary studies, further substantiation is needed. These variables include high parental monitoring, association with female smoking peers, high religiousness, and involvement in work-for-pay activities.

Study Limits

Three major study limitations deserve comment. First, given that it was beyond the scope of the research to conduct a statistical meta-analysis (or document and compare effect sizes across primary studies using systematic procedures), universal weight was given to studies with different sample and effect sizes. In consequence, the directional findings that were presented and discussed do not speak to or clarify whether those relationships meeting the .05 alpha-level are significant due to the size of the sample employed or the actual size of the effect. Effect sizes are partly contingent on the size of the sample (McCormick, Rodney, & Varcoe, 2003; Preiss & Allen, 1995), so a relationship in one study may meet the significance threshold simply because the sample utilized was relatively large. In this instance, however, the effect size may actually be small. The reverse also may hold true. It is recommended that future reviews of the literature base build upon the first solid step taken here and use statistical meta-analytic techniques to replicate the findings that were presented. By weighting individual studies, effect size comparisons across studies can be facilitated.

Second, the quality of this systematic review (like a statistical meta-analysis) is rooted, in part, in the quality of the primary studies upon which the review findings are based. Hence, the validity of the findings reported here, while consistent with some of Conrad and colleagues' (1992) age-specific results, should be viewed in light of the limitations of the primary studies that previously were detailed. Additional knowledge concerning age-graded effects may have been generated had all of the primary studies reported the direction of insignificant relationships.

Finally, since only empirical studies published between 1970 and 2007 were subject for appraisal (if other inclusion criteria were met), relevant research published within the past 1.5 years was not appraised. Prior to 1970, little research on predictors of cigarette initiation took a multivariate approach to prediction. The specified 2007 delimit was chosen simply because a considerable amount of time was needed to complete the study. While any appraisal benefits from the assessment of a large number of studies, this review arguably bridges two major gaps in the literature, voids that can be cross-validated with findings from future reviews that include more recent published research in this area.

Suggestions for Future Research

The findings from this review underscore a plethora of literature voids that future research can address. Since the bulk of these gaps were detailed above, for the sake of brevity, only glaring voids are brought to the forefront here.

In general, little research attention has been directed at community-related determinants of cigarette initiation among youth of all ages. Onset during late adolescence needs some special attention, however.

The social development model (Catalano & Hawkins, 1996) posits that community factors are more important in determining the behavior of late adolescent youth than the behavior of children and teens during early and mid-adolescence. The validity of this assertion should be, but was unable to be, assessed, because none of the primary studies investigated community domain predictors of cigarette onset among late adolescent youth.

Additional research on the influence of school-related factors also would be informative, particularly the efficacy of school attachment and truancy for predicting cigarette initiation among youth at all ages. Walter et al.'s (1991) cross-sectional study did assess the impact of truancy on cigarette initiation among 10th grade students; however, the direction of insignificant effects was not included in the published report. With respect to the peer domain, none of the studies included in the review evaluated the utility of peer drug use and peer drug norms for predicting smoking initiation among late adolescent youth.

Finally, two major literature gaps that deal with the individual domain can be addressed through further study: the nature and role of work-for-pay activities and the effects of alcohol use intentions on the likelihood of cigarette initiation. A growing body of research indicates that alcohol tends to be initiated prior to cigarette use (see, e.g., Andrews et al., 1991; Costello, Erkanli, Federman, & Angold, 1999; Ellickson, Hays, & Bell, 1992; Federman, Costello, Angold, Farmer, & Erkanli, 1997; Hawkins, Hill, Guo, & Battin-Pearson, 2002; Kandel, 1975; Yu & Williford, 1992). It is unclear, however, whether differential availability or a combination of availability and drug-specific norms that explains the existence of this initiation sequence.

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