Factors associated with risk behaviors in adolescence: a systematic review

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Objective: Understanding the distal (≤ 6 years of age) and proximal (between 6 years of age and early adolescence) factors in adolescent risk behavior is important for preventing and reducing morbidity and mortality in this population. This study sought to investigate the factors associated with the following adolescent risk behaviors: i) aggressiveness and violence, ii) tobacco, alcohol, and illicit substance use, iii) depressive behavior and self-harm (including suicidal ideation and attempts), iv) sexual risk behavior, and v) multiple risk behavior.

Methods: A systematic review was conducted to identify longitudinal studies that examined factors associated with adolescent risk behaviors. The PubMed, PsycINFO, and LILACS databases were searched.

Results: Of the 249 included studies, 23% reported distal risk factors, while the remaining reported proximal risk factors. Risk factors were related to sociodemographic characteristics (neighborhood, school, and peers), family patterns, and the presence of other adolescent risk behaviors.

Conclusion: Distal and proximal factors in adolescent risk behavior that are not exclusively socioeconomic, familial, environmental, or social should be explored more thoroughly.

Keywords: Adolescent behavior; risk factors; risk behavior

Introduction

Adolescent risk behavior is participation in activities that may cause physical or mental harm, such as unintentional injuries and exposure to violence, sexual risk behavior (unsafe sexual behavior that may result in health consequences, such as unintended pregnancy and sexually transmitted diseases), and tobacco, alcohol, and illicit substance use.1 Although such activities are often sporadic, if a consolidated pattern of risky behavior is not identified early and effectively monitored, the individual's health, as well as his or her social and family ties, may be severely harmed.1

There is an increased interest in studying risk behavior in adolescents due to its high correlation with morbidity and mortality.1-3 These behaviors may also directly affect an individual's human capital, i.e., the set of educational and cultural assets that determine his or her well-being over time.2,3 Thus, a better understanding of the factors in adolescent risk behavior is important for interventions to prevent this pattern of behavior in adult life. In addition, those who engage in any one risk behavior are likely to engage in others, and the behaviors may have common factors that predict their development. Hence, a growing body of research suggests that health risk behaviors often do not occur in isolation. Smoking, drinking, illicit drug use, sexual risk taking, and aggression are all mutually predictive.4

Theoretical models can clarify the dynamics of factors that influence the onset and perpetuation of risk behaviors. The Developmental-Ecological Framework, for example, posits that individual development and behaviors are influenced by the adolescent’s social environment (e.g., family, school, and neighborhood).5 Some health programs designed to prevent and treat specific risk behaviors in adolescence, are guided by the Social Development Model,7 which postulates that children and adolescents shape their attitudes from four socializing units: family, school, religious and community institutions, and peers. There is also evidence that individual personality traits and temperament are determinants of specific behaviors.8

A theoretical model is shown in Figure 1.

The majority of studies on the factors involved in adolescent risk behaviors are cross-sectional or focused on proximal factors, i.e., those that occur after early childhood (before age 6, a critical and sensitive period of development).9,10 In addition, few studies have established a direct causal relationship between exposure (risk factor) and outcome (risk behavior). This systematic review will

allow a description of the factors associated with adolescent risk behavior in the literature, as well as those that still require investigation. In-depth knowledge of the factors associated with adolescent risk behaviors could help prevent them, consequently reducing morbidity and mortality in this age group.

Although many systematic reviews have been conducted on adolescent risk behavior and its associated factors, they have generally studied the factors associated with a single behavior or the association between several behaviors and a single factor. Furthermore, no systematic review has used only longitudinal studies to assess the main adolescent risk behaviors and all associated factors. Hence, the aim of this report is to review the literature on distal and proximal factors associated with adolescent risk behaviors (sexual risk behavior, violent/aggressive behavior, substance use or abuse, depressive/suicidal behavior and self-harm, and multiple risk behaviors — i.e., two or more of the aforementioned risk behaviors) and to provide an overview of the subject.

Methods

Protocol and registration

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement. The study protocol has been published in the PROSPERO registry (CRD 42018092963).

Information sources

A comprehensive literature search of the electronic databases PubMed, PsycINFO, and Lilacs was conducted from February 16, 2018 to August 9, 2018.

Search strategy and study eligibility

The articles were retrieved through the following search strategies: 1) on PubMed: (Adolescent Behavior OR Behavior, Adolescent OR Adolescent Behaviors OR Behaviors, Adolescent) AND (Risk Factors OR Factor, Risk OR Factors, Risk OR Risk Factor OR Population at Risk OR Risk, Population at OR Populations at Risk OR Risk, Populations at OR Pregnancy in Adolescence OR Alcohol Drinking OR Alcohol Drinking in College OR Binge Drinking OR Underage Drinking OR Aggression OR Substance-Related Disorders OR Tobacco Use OR Depressive Disorder OR Suicidal Ideation); 2) on Lilacs: Adolescent behavior AND Risk Factors; and 3) on PsycINFO: Adolescent behavior AND Risk factors.

The articles were grouped and structured according to the PICOS strategy: P (population) people between 10-19
years old, defined as adolescents by the World Health Organization\(^\text{17}\); I (intervention/ exposure) related to factors associated with risk behaviors; C (comparison) for absence of risk behavior; O (outcome) risk behaviors, such as substances use, including alcohol and smoking tobacco, sexual risk behavior, aggressiveness and violence, self-harm, depressive and suicidal behavior; multiple risk behavior; and S (study design) longitudinal studies. These outcomes have been described as the most prevalent risk behaviors in adolescence. For instance, the prevalence of hazardous drinking is 34% among 15- to 16-year olds.\(^\text{18}\) In addition, smoking, aggression, and, depression affect an individual's entire life cycle and negatively impact health in adulthood.\(^\text{19}\) Although a mental health problem, we included depressive symptoms due to their strong association with other risk behaviors, such as self-harm, suicidal ideation, substance use, and sexual risk behavior.\(^\text{20}\) The exclusive selection of longitudinal studies enabled us to examine factors that predict risk behaviors in adolescence, and also allowed us to ensure that the exposure occurred before the outcome, even for studies focusing on proximal risk factors, whose follow-up period is shorter than that of studies focusing on distal factors (i.e., those occurring in the first 6 years of life).\(^\text{21}\) Proximal risk factors were considered those that occurred prior to the outcome but after early childhood, and they can be described in retrospective or prospective studies.

**Study selection**

The search strategy we used for each database covered the maximum number of articles, and the selection process included several steps. First, the titles and abstracts were screened. Next, we excluded articles that did not fit the selection criteria or were duplicates; two investigators independently screened the article titles and abstracts. Potentially relevant articles were then retrieved, and two investigators independently assessed the full texts to determine which ones met the eligibility criteria. Further information about which authors performed each step is available in the online-only supplementary material (author contributions).

**Risk of bias in individual studies**

Two investigators independently assessed the risk of bias of the included studies with the Newcastle-Ottawa Scale (NOS) for cohort studies.\(^\text{22}\) The NOS uses eight criteria to evaluate selection bias, cohort comparability, and outcome assessment, and has been used in another risk behavior-related review.\(^\text{23,24}\) The NOS quality assessment form for cohort studies classifies them as good quality, fair quality, or poor quality. NOS classification considers the quality of the following criteria: population selection, comparability, and outcome assessment. Poor quality means zero points in any one of these three criteria. Of note, according to the PRISMA statement, NOS quality should not be considered as an exclusion or inclusion criterion for a systematic review. Thus, no studies were excluded exclusively on NOS quality classification.

**Data collection process**

Two investigators extracted the data (study design, setting, population, risk behavior, associated risk factors, follow-up period, results, adjustment variables, covariates, and NOS score) from the articles. The data obtained from the selected studies were included in a summary table, and a descriptive analysis was performed. Adjusted results were reported when possible. Due to the studies’ heterogeneity, such as different populations, the number of risk behaviors, and risk factors, no meta-analysis was attempted.

**Results**

The database searches identified 10,050 article titles and, after removing duplicates, 815 titles and abstracts were screened. The full text of 516 articles was assessed for eligibility and 249 studies met the inclusion criteria. The complete flowchart is shown in Figure 2.

**Descriptive analysis**

A summary of the results is described in Table 1. The detailed results are presented in Table S1, available as online-only supplementary material.

**Sample characteristics**

The majority (90%) of the studies included in this review analyzed both boys and girls, although approximately 7% included only girls, particularly studies on sexual risk behavior such as pregnancy in adolescence. In almost 40% of the studies, the sample included adolescents aged 10 to 14 years at outcome, while 62.2% used self-report questionnaires as a survey method.

**Source/ country**

Of the 249 included longitudinal studies, 45% (112) were conducted in the United States, followed by the United Kingdom (15%) and Australia (10%). Only eight studies were included from South America (3%): four from Brazil, two from Mexico, and two from Chile. The other studies were conducted in Canada, Malaysia, Finland, Sweden, Denmark, Germany, Taiwan, Korea, China, South Africa, Tunisia, and Mauritius. Four studies were multicenter, three of which were conducted in Europe.

**Newcastle-Ottawa Scale quality**

Of the 249 studies, 151 (60.6%) were classified as good quality, 64 (25.7%) as fair quality, and a minority (13.7%) as poor quality.

**Prospective vs. retrospective cohort studies**

Regarding study design, 12 of the included studies (5%) were retrospective cohort studies and 237 (95%) were prospective cohort studies.
Year of publication

The minority (12.5%) of the studies were published between 1994 and 1999, whereas the majority were published between 2000 and 2018.

Risk behavior and its associated factors

The most frequent main outcome (risk behavior) was substance use, including alcohol and tobacco (45%), followed by depressive/suicidal/self-harm behavior (21.6%), violent or aggressive behavior (14%), sexual risk behavior (11%), and two or more risk behaviors (8.4%).

Only 23% (56) of the studies reported early childhood factors (including intrauterine factors) associated with adolescent risk behavior, mainly those related to aggressive behavior, and the majority were prospective cohort studies. Almost 80% of the included studies were restricted to proximal exposure (after the first 6 years of life), which involved shorter follow-up times.

The main early childhood factors associated with adolescent risk behavior were nicotine exposure during pregnancy, low socioeconomic status at birth, and adverse childhood experiences, such as prenatal exposure to drugs and poverty. Individual traits, such as internalizing and externalizing symptoms in the first 6 years of life, were also addressed in some studies as predictors or mediators of adolescent risk behaviors.

Intrauterine exposure to alcohol, cocaine, lead, caffeine, and dexamethasone were also addressed in a few studies. Birth conditions (low birth weight, prematurity, delivery complications), family emotional expressiveness (such as maternal attitudes to pregnancy and postpartum care), and maternal depression in the child's early life were rarely described as risk factors for adolescent risk behavior.

The included studies examined 44 different (distal and proximal) types of factors. The following sections describe the factors significantly associated with each adolescent risk behavior in the majority of the articles.

Alcohol and other substance use

The distal risk factors for adolescent alcohol use were: intrauterine alcohol exposure (in one study it was only significant for girls, while in another it was significant for both sexes), maternal depression in early childhood, low maternal age at birth, cumulative adverse experiences in early childhood, externalizing symptoms, and low family income at birth. However, Melotti et al. reported a higher family income at birth as a risk factor for adolescent drinking. The mother's negative feelings about being pregnant and having an unwanted/unplanned pregnancy predicted alcohol initiation by age 14. Edwards et al. found that internalizing symptoms in childhood were distal protective factors against adolescent drinking.
Proximal risk factors for adolescent alcohol use included: sibling and peer alcohol use, residing in an urban area, parental alcohol use or abuse, parental separation, and a single mother family. Parental style (overprotection) was associated with regular alcohol use in adolescence.46-48 Prior behavior problems predicted alcohol initiation by age 11-13.49 Smoking, easy access to alcohol, and truancy were associated with alcohol consumption by age 14.50 Bullying victimization was positively associated with drinking and risky drinking. Externalizing symptoms (maladaptive behaviors directed toward one’s environment) by age 8 (after early childhood), low locus of control, depressive symptoms, poor parental attachment, and low school connectedness were significantly associated with alcohol use. Early puberty and low sports participation increased the risk of binge drinking.51-54 An important proximal protective factor for alcohol use was more family meals and a secure adolescent-parent attachment.47 High socioeconomic status and an authoritarian parental style were also protective factors against binge drinking.65

No distal risk factors were described regarding onset of cannabis use. Proximal factors, such as knowing slang words for cannabis, signaled a markedly increased risk for subsequent cannabis use.56 Prior history of smoking, alcohol consumption, antisocial behavior, intention to use drugs, drug use among friends, and spending leisure time in bars were independent risk factors for cannabis use in both sexes.56 Maternal smoking, friends who smoke tobacco, low parental monitoring, and having smoked tobacco by age 11 were risk factors for cannabis use by age 17-18.57,58 Regarding the use of other substances, males with conduct problems were at higher risk of using multiple substances (cocaine, alcohol, cannabis), and early puberty was positively associated with substance use in middle adolescence for both sexes.49

Smoking tobacco

The distal risk factors for smoking in adolescence were: behavioral and emotional problems during infancy, maternal smoking during pregnancy (in several good quality studies), boys born to single mothers, girls with high stress at age 3, and exposure to maternal depression at 4-5 years old.25,28,59

The proximal risk factors for smoking in adolescence were: child depression, maternal depression, current maternal smoking, peer drug use, parental separation, thrill seeking behavior, stress, other risk behaviors, and the father’s use of snus (Swedish snuff).60,61 In addition, exposure to tobacco advertising was associated with smoking in adolescence, even after controlling for socioeconomic factors. Low self-esteem in girls was a predictor of smoking.62 Poor academic performance, parental smoking, and having friends who smoke all independently predicted heavy smoking.61,63,64 Depression and prior cigarette consumption were associated with smoking in adolescence.65 Fights, previous experience with alcohol, an absent father, male gender, a poor relationship with the mother, corporal punishment by parents, and family conflict were associated with smoking in adolescence (by 11.3 years of age).66 Early puberty in both sexes was an independent risk factor for regular smoking in adolescence. Although attention deficit and hyperactivity disorder symptoms were associated with smoking in adolescence, this relationship was mediated by school adjustment.68 Using e-cigarettes in the past 30 days was

Table 1 Summary of the 249 eligible studies

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All studies (n=249)</th>
<th>Substance use (n=113)</th>
<th>Aggressiveness and violence (n=35)</th>
<th>Self-harm, depressive, suicidal behavior (n=54)</th>
<th>Multiple risk behavior (n=21)</th>
<th>Sexual risk behavior (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>112 (45.0)</td>
<td>48 (42.0)</td>
<td>23 (65.7)</td>
<td>19 (35.0)</td>
<td>7 (33.0)</td>
<td>15 (57.6)</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>37 (15.0)</td>
<td>14 (12.0)</td>
<td>2 (5.7)</td>
<td>16 (29.6)</td>
<td>2 (9.5)</td>
<td>3 (11.5)</td>
</tr>
<tr>
<td>Australia</td>
<td>24 (10.0)</td>
<td>13 (12.0)</td>
<td>3 (8.6)</td>
<td>4 (7.4)</td>
<td>2 (9.5)</td>
<td>2 (7.9)</td>
</tr>
<tr>
<td>Other</td>
<td>76 (30.0)</td>
<td>38 (34.0)</td>
<td>7 (20.0)</td>
<td>15 (28.0)</td>
<td>10 (48.0)</td>
<td>6 (23.0)</td>
</tr>
<tr>
<td>Sample age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>96 (38.5)</td>
<td>51 (45.1)</td>
<td>14 (40.0)</td>
<td>18 (33.4)</td>
<td>8 (38.0)</td>
<td>5 (19.0)</td>
</tr>
<tr>
<td>15-19</td>
<td>78 (31.4)</td>
<td>29 (25.7)</td>
<td>9 (25.7)</td>
<td>19 (35.1)</td>
<td>6 (28.5)</td>
<td>15 (58.0)</td>
</tr>
<tr>
<td>Other</td>
<td>75 (30.1)</td>
<td>33 (29.2)</td>
<td>12 (34.3)</td>
<td>17 (31.5)</td>
<td>7 (33.5)</td>
<td>6 (23.0)</td>
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<tr>
<td>Years of follow-up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>193 (77.5)</td>
<td>90 (79.6)</td>
<td>22 (63.0)</td>
<td>44 (81.5)</td>
<td>13 (62.0)</td>
<td>24 (92.3)</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>56 (22.5)</td>
<td>23 (20.4)</td>
<td>13 (37.0)</td>
<td>10 (18.5)</td>
<td>8 (38.0)</td>
<td>2 (7.7)</td>
</tr>
<tr>
<td>Exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal risk factor</td>
<td>56 (22.5)</td>
<td>24 (21.2)</td>
<td>15 (43.0)</td>
<td>8 (14.8)</td>
<td>7 (33.0)</td>
<td>2 (7.7)</td>
</tr>
<tr>
<td>Distal protective factor</td>
<td>3 (1.2)</td>
<td>2 (1.8)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Proximal risk factor</td>
<td>191 (76.0)</td>
<td>88 (78.0)</td>
<td>20 (57.0)</td>
<td>44 (81.5)</td>
<td>14 (67.0)</td>
<td>25 (96.2)</td>
</tr>
<tr>
<td>Proximal protective factor</td>
<td>5 (2.0)</td>
<td>2 (1.8)</td>
<td>1 (3.0)</td>
<td>2 (3.7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Study design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prospective</td>
<td>237 (95.0)</td>
<td>109 (96.5)</td>
<td>31 (88.5)</td>
<td>53 (98.0)</td>
<td>20 (95.0)</td>
<td>24 (92.3)</td>
</tr>
<tr>
<td>Retrospective</td>
<td>12 (5.0)</td>
<td>4 (3.5)</td>
<td>4 (11.5)</td>
<td>1 (2.0)</td>
<td>1 (5.0)</td>
<td>2 (7.7)</td>
</tr>
</tbody>
</table>

Data presented as n (%).
associated with initiation of smoking and daily smoking.\textsuperscript{69} Water-pipe smoking increased the risk of conventional smoking.\textsuperscript{70} Barriers to smoking in public places, negative perception of the tobacco industry, and nonsmoking policies were described as proximal protective factors against smoking in adolescence.\textsuperscript{71} Unlike the majority of literature, De Vries et al.\textsuperscript{72} concluded that peer smoking was not a predictor of smoking in adolescence, and justified the result as a selection paradigm: adolescents choose friends with similar tobacco-related behaviors.

**Depressive/suicidal/self-harm behavior**

The distal risk factors for depressive behavior in adolescence were: shyness at age 6, child abuse or neglect in early childhood, low birth weight, number/frequency of real and/or perceived physical issues, and internalizing problems.\textsuperscript{73,74} Prematurity (less than 26 weeks) was a risk factor for depressive symptoms at age 11.\textsuperscript{38} Prenatal maternal depression was a predictor of adolescent depressive symptoms, after controlling for variables such as maternal education, maternal age at delivery, gender, smoking, and alcohol use during pregnancy.\textsuperscript{42} Maternal consumption of more than eight cups of tea or coffee per day during pregnancy was associated with depressive disorder at age 11, even after adjusting for covariates.\textsuperscript{37} Locus of control mediated the association between socioeconomic adversity in infancy and depression in adolescence.\textsuperscript{75} Compared to hydrocortisone or nothing, dexamethasone exposure at birth was reported as a risk factor for depressive behavior in adolescence.\textsuperscript{74} No distal protective factors against depressive behavior in adolescence were described.

The proximal risk factors for depressive symptoms in adolescence were a socioeconomically disadvantaged neighborhood and having experimented with drugs. Having engaged in two or more health risk behaviors predicted depressive symptoms (adjusted for age, ethnicity, obesity, and general health status).\textsuperscript{76} Low school connectedness, lack of parental affection, parental conflict, parental separation, cyberbullying victimization, bullying victimization by age 15, female gender, low income, levels of religious activity, and no suicidal self-injury were risk factors for depressive behavior during adolescence.\textsuperscript{77,78} Self-identification as a goth at age 15 was associated with depression at age 18.\textsuperscript{79} Family connectedness, parental warmth, peer acceptance, better school performance, and religious activity were reported as proximal protective factors for depression.\textsuperscript{77} Maternal depression and ongoing anxiety were not associated with depression in adolescence.\textsuperscript{45}

Concerning the distal risk factors for self-injury and suicidal behavior: emotional disorders in early childhood were cited as a risk for later suicidal ideation and suicide attempts, adoption was an independent risk factor for attempted suicide in adolescence, and low socioeconomic status at birth was also associated with self-harm without suicide attempt at age 16.\textsuperscript{80} No distal protective factors were described.

The proximal risk factors for self-injury included: involvement in violence at age 14 (associated with suicidal ideation one year later),\textsuperscript{81} health problems (e.g., muscle pain and tension, overweight), and conduct problems at age 9 (associated with suicidal ideation at age 15).\textsuperscript{82} Depression, parental conflict, other risk behaviors (e.g., smoking), anxiety at age 9, being a male bullying victim, and being a female bully were risk factors for posterior suicidal ideation.\textsuperscript{83} Exposure to frequent bullying, poor school connectedness, poor neighborhood safety and cohesion, and maternal suicidal intent were associated with self-harm.\textsuperscript{84,85} Being adopted was an independent risk factor for attempted suicide in adolescence. Self-identification as a goth at age 15 was associated with self-harm at age 18.\textsuperscript{87} Violent methods of self-harm were independently associated with attempted suicide.\textsuperscript{88}

**Aggressive/violent behavior**

The distal risk factors for aggressive behavior in adolescents were: prenatal exposure to lead,\textsuperscript{83} early childhood exposure to family violence and alcohol abuse, and child abuse (regardless of whether it occurred at home or in foster care).\textsuperscript{87} In addition, intrauterine exposure to tobacco was associated with delinquency at age 12.\textsuperscript{88} Maternal alcohol consumption during pregnancy was associated with antisocial behavior in adolescence. Gestational hypertension and preeclampsia were positively associated with aggressive behavior at age 14.\textsuperscript{38} Birth complications, psychosocial adversity, abuse, maladaptive parental behavior, socioeconomic disadvantage, and malnutrition were distal risk factors for aggressive behavior and delinquency, and externalizing symptoms in infancy were described as a mediator.\textsuperscript{89} Other early factors included: exposure to maternal depressive symptoms at 4-5 years of age, unplanned pregnancy, maternal urinary tract infection during pregnancy, low maternal education, and being born to a single mother. Low maternal age and having three or more siblings (associated with aggressive behavior at age 11).\textsuperscript{90} Childhood exposure to violence and parental rejection were associated with violent behavior at age 16.\textsuperscript{91} Maternal consumption of more than eight cups of tea or coffee per day during pregnancy was associated with conduct/oppositional disorder at age 11, even after adjusting for a number of covariates.\textsuperscript{37}

The proximal risk factors for aggressive behavior in adolescence described in the included studies included neighborhood socioeconomic disadvantage, current access to guns, male gender, depression, tobacco use, substance use, disruptive behavior in early adolescence, early substance use, early puberty, hyperactivity, poor academic performance, peer delinquency, availability of drugs in the neighborhood, perceived discrimination, and parental separation in early adolescence.\textsuperscript{92-96}

**Sexual risk behavior**

The distal risk factors for sexual risk behavior in adolescence were childhood sexual abuse,\textsuperscript{95,97} persistent conduct problems during childhood, low income, and low maternal education. Low maternal age at delivery and behavioral and emotional problems at age 5 were risk
Factors for early sexual activity (before 16 years of age). Externalizing problems at age 2 increased the risk of unwanted sex (not forced but not spontaneously desired) at age 15 for girls, and the risk of multiple sexual partners for boys. Attention deficit and hyperactivity disorder, oppositional defiant disorder, and conduct disorder were associated with sexual intercourse before 16 years of age. The proximal risk factors for sexual risk behavior in adolescence were: lack of interests outside the home at age 13 and no religious activity at age 11. Low school connectedness at age 15 and a diagnosis of conduct disorder were described as risk factors for sexual activity before 16 years of age in males. For females, high self-esteem, early menarche, planning to quit school, and low school connectedness were risk factors for early sexual activity. Low maternal monitoring, high older sister power, and low sibling conflict were factors for sexual risk behavior 3 years later. Having a previous sexually transmitted disease was a risk factor for contracting a new one in adolescence. Marijuana use by one of the partners was found to be a risk factor for not using condoms. Risk factors for adolescent pregnancy included: a positive desire to become pregnant, early conduct problems, less than 8 years of education, multiple sexual partners, and being single. Finally, a higher level of parental monitoring and good grades were proximal protective factors for sexually transmitted diseases such as gonorrhea and chlamydia.

Multiple risk behavior

The distal factors of multiple risk behavior were adverse childhood experiences, including low family income (assessed when the child was 2-4 years of age), and other social determinants, such as low maternal education level. In relation to proximal factors in multiple risk behavior, low parental social class, low maternal education, and low household income were directly and significantly associated with more risk behaviors at age 15.

Discussion

Distal risk factors

In this review we have described three basic ways in which the lifelong effects of distal factors impact a child’s future health and behavior: i) prenatal factors, such as maternal depression, tobacco, alcohol, caffeine, and other substance use during pregnancy; ii) birth conditions, such as prematurity and low birth weight; iii) experiences during early life, such as adverse experiences (abuse, neglect, family violence, adoption), low family income, and maternal or caregiver emotional problems. Hence, the majority of the distal factors in adolescent risk behavior described in this study could be considered social determinants of health, i.e. the nonmedical conditions in which people are born, mature, work, live, and age, and the broader set of forces and systems that shape the conditions of daily life. These nonmedical conditions, such as sustained poverty, low parental education, and family violence, determine patterns that can negatively impact the environment in which children are born, live, and mature, thereby influencing their health, development, and well-being.

Distal protective factors

Protective factors mediate or moderate the effect of exposure to risk factors, resulting in a reduced incidence of the problem behavior. These protective factors for behavior outcomes in adolescence fall into three basic categories: individual traits (positive social orientation, high intelligence, and a resilient temperament), social bonding (warmth, affective relationships, and commitment), and healthy behavior patterns. There is a consensus that during early childhood, having good affective experiences and bonds, as well as growing in a stable and safe environment, improves emotional development and, consequently, has a positive impact on mental health and behavior during adolescence and adulthood.

However, in this systematic review, few studies reported on distal protective factors for risk behaviors in adolescence; only two reports (both concerning substance use) described distal protective factors. No studies investigated distal protective factors, such as the quality of the mother-child bond or breastfeeding duration, for instance. The literature found in this review was more focused on the factors involved in risk behaviors. Perhaps this finding could be explained by evidence from previous epidemiological studies indicating that health programs and policies for children and youth should focus only on risk factors to reduce the prevalence of problem behavior in adolescence. Nevertheless, some authors have advocated focusing exclusively on protective factors associated with resilience, rather than trying to reduce risk factors, i.e., emphasizing “prevention” rather than the “problem.” Other authors have argued that focusing solely on protective factors ignores the importance of social and contextual risk factors, which should also be considered in prevention policies and interventions.

Proximal risk factors

The proximal factors for adolescent risk behavior described in this systematic review are well established in the literature, and are basically synonymous with social determinants of health. They could be divided into structural determinants, which are the fundamental structures of society that create social stratification (such as national wealth, income inequality, educational status, gender, and ethnicity), and proximal or intermediate determinants, which are considered the circumstances of daily life (such as the quality of the family environment, peer relationships, the availability of food, housing, recreation, and access to education). Proximal factors are created by social stratification (i.e., structural determinants), as well as by cultural, religious, and community factors. There is strong evidence that these proximal social and educational factors affect the vulnerability and exposure of young people to health risk behaviors and conditions. This evidence is derived from traditional efforts to
prevent substance abuse, sexual risk behavior, violence, delinquency, and poor mental health in adolescence.\textsuperscript{118,119}

The family has an important role in proximal factors: low parental monitoring, parental conflict, and sibling conflict are factors in several risk behaviors.\textsuperscript{77,78,101} In high-income countries, disadvantaged neighborhoods have been associated with poor educational attainment,\textsuperscript{120} teenage pregnancy,\textsuperscript{121} poor mental health,\textsuperscript{122} and violence in adolescence. Peers also play a crucial role: the emergence of strong peer relationships is one of the key developmental changes of early adolescence, and peers can have a positive or negative influence on behavior.\textsuperscript{123} Finally, individual traits, such as other risk behaviors or a mental disorder, are frequently described as factors for risk behaviors.\textsuperscript{76,102}

Thus, sociodemographic factors, family patterns, neighborhood, peers, risk behavior, and mental disorders are currently the most studied determinants of adolescent risk behavior. Health policies must combine interventions at the individual, school, and family levels. Individual traits, such as low self-esteem,\textsuperscript{62} early puberty,\textsuperscript{49} and other physical problems,\textsuperscript{82} were rarely described as factors associated with risk behaviors. These individual risk factors require further investigation since, given the difficulty of intervening in environmental, neighborhood, and family structures, health professionals could work directly with adolescents.

**Proximal protective factors**

According to Rutter,\textsuperscript{124} protective factors and risk factors should be treated as conceptually distinct rather than as opposite ends of a single dimension. Thus, protective factors are considered independent variables that can have their own effects on behavior but can also moderate the relation between risk factors and behaviors.\textsuperscript{125} Hence, protective factors could play a key role when exposure to risk is unavoidable and essentially constant. Several protective factors for behavioral outcomes have been explored. The literature reports\textsuperscript{125,126} three categories of protective variables:

i) dispositional attributes, that is, individual differences, such as high self-efficacy; ii) family attributes, such as parental support and affection; and iii) extrafamilial circumstances, such as support from other adults or strong community integration.

In this review, proximal protective factors for risk behaviors were poorly reported, and no proximal protective factors were described for multiple risk behavior or sexual risk behavior. Furthermore, the majority of the reported proximal protective factors were either “extrafamilial circumstances” (e.g., nonsmoking policies, peer acceptance, better school performance, religious activity) or “family attributes” (e.g. parental warmth and parental style). It has become evident that adolescents whose parents are highly knowledgeable about their activities are less likely to engage in problem behavior, including sexual risk behaviors,\textsuperscript{101} violence,\textsuperscript{96} and substance abuse.\textsuperscript{47} In the present review, we found that individual protective factors for risk behaviors have been poorly explored. These should be more thoroughly investigated, since they could be used to promote resilience and reduce risk behavior in adolescents.

**Strengths and limitations**

This review followed the recommended procedures for rigorous systematic reviews. To identify as many relevant studies as possible and reduce the risk of publication bias, a highly sensitive search strategy was used and an extensive range of resources were searched, including electronic databases, guidelines, and systematic reviews. Another important strength was the fact that only longitudinal studies were included. This has enabled us to examine factors that predict risk behaviors in adolescence and ensured that exposure occurred before the outcome. Furthermore, our results align with previous findings, and the majority (almost 80%) of the included studies presented an adjusted analysis for covariates, which reduces confounding and strengthens the causal inference between exposure and outcome. Another advantage is the high number of included studies from a broad variety of locations and populations, amplifying consistency and also contributing to causal inference.\textsuperscript{127}

Despite the selection and information biases implicit in cohort studies, the NOS criteria were applied to each included study, ensuring the quality of the results and an awareness of bias. Although the majority of the included studies (60%) were classified as good quality with low risk of bias, almost half (40%) were classified as fair or poor quality, which indicates an increased risk of selection and information biases. This could be considered a limitation.

**Conclusions**

This systematic review found few reports on distal factors in adolescent risk behavior, particularly medical factors, such as gestational and delivery complications, and emotional and/or psychological problems during early childhood. We also found that distal protective factors for risk behavior in adolescence were poorly explored, since only two reports described distal protective factors for substance use (both related to socioeconomic status at birth). No reports were found on distal risk factors for other risk behaviors, such as aggressiveness, sexual risk behavior, depressive and suicidal behavior, or self-harm, and no studies investigated an association of factors (such as mother-child bond, breastfeeding duration, maternal emotional status during and after pregnancy, and maternal emotional support during and after pregnancy) with risk behaviors in adolescence, for instance. Finally, the physical and psychological traits of individual adolescents were rarely investigated as proximal factors for risk behaviors. The literature focuses much more on social, environmental, school, neighborhood, and family factors. Individual traits should be better explored, since they could be an easier and proximal target for intervention by health professionals.

**Recommendations**

Public policies that aim to prevent risk behaviors in adolescence should intervene in the social determinants
of health, since they are significantly associated with several risk behaviors in adolescence. Nevertheless, the distal and proximal risk and protective factors for risk behaviors in adolescence, whether medical, psychological, or individual, cannot be forgotten by researchers, since interventions in these determinants could be promoted not only through public health policies, but also by pediatricians, obstetricians, and other health professionals in the primary care system.

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Factors associated with risk behaviors in adolescence


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