Published in final edited form as:

Diabetes Educ. 2011 November ; 37(6): 756–764. doi:10.1177/0145721711422610.

Risky Business: Risk Behaviors in Adolescents With Type 1 Diabetes

Dr Sarah S. Jaser, PhD, Ms Heather Yates, MSN, Ms Susan Dumser, MSN, RN, and Dr Robin Whittemore, PhD, APRN, FAAN

Yale University School of Nursing, New Haven, Connecticut (Dr Jaser, Ms Yates, Dr Whittemore), and the Children's Hospital of Philadelphia, Pennsylvania (Ms Dumser)

Abstract

Purpose—The purpose of this article is to review risk behaviors and their health consequences in adolescents with type 1 diabetes. The existing literature on common risk behaviors in adolescents is examined, with a focus on illicit drug use, alcohol use, smoking, unprotected sexual activity, and disordered eating behaviors.

Conclusions—A review of the literature highlights the lack of studies of risk behaviors in this population. Much of what is known comes from studies with adolescents in the general population or from studies of adults with type 1 diabetes. Known risk and protective factors for risk behaviors and health outcomes are noted. Based on these findings, suggestions are provided for diabetes educators and health care providers to assess for and prevent risk behaviors in adolescents with type 1 diabetes. Directions for future research in this population are indicated, including the need to develop and test standardized prevention programs.

Adolescence is a time of great physical and emotional growth, risk taking, and vulnerability. Adolescents partake in numerous behaviors that may be detrimental to their health, such as unprotected sex and disordered eating behaviors. In addition, illicit drug, alcohol, and tobacco use is common in high school students. In 2009, the Centers for Disease Control and Prevention's Youth Risk Behavior Surveillance found that among American high school students, 73% had consumed alcohol, 46% had ever smoked a cigarette, and 46% were sexually active.¹ In another national survey, 48% of 12th graders reported that they had tried illicit drugs in their lifetime (most commonly, marijuana).² Thus, these behaviors are occurring at high rates in healthy teens who do not have the developmental capacity to fully appreciate the potential negative impact of these behaviors on their health. Because adolescents have immature prefrontal cortex development, they may feel that they are invincible to the outcomes of their risk behaviors.³ The purpose of this article is to explore the impact of alcohol, tobacco, and illicit drug use; risky sexual behavior; and disordered eating behavior on metabolic control in adolescents with type 1 diabetes and to provide recommendations to diabetes educators and health care providers as to how they can effectively minimize the risk to adolescents with diabetes.

Type 1 diabetes is one of the most common chronic diseases of childhood, with a peak age of onset during adolescence.⁴ Glycemic control often deteriorates in adolescence owing to the numerous physiologic and psychosocial changes that occur during this developmental stage, including increased insulin resistance related to the insulin agonist impact of pubertal

hormones, significant weight gain, and a need for increased insulin dosage,⁵ as well as increasing independence from parents. Unfortunately, this newfound autonomy often leads to poor self-management, which exacerbates poor glycemic control.⁶ In addition, adolescents with chronic conditions may be even more likely to engage in risk behaviors than their peers,⁷ and these behaviors have the potential for greater adverse health outcomes in chronically ill youth.⁸ Surprisingly, the exact impact that risk behaviors have on glycemic control has not been extensively explored in adolescents with type 1 diabetes. To provide appropriate counseling and treatment recommendations, health care providers and diabetes educators need to be aware of the kinds of behaviors that adolescents are most likely to engage in and how these behaviors may affect their glycemic control and other health outcomes.

The risk behavior in adolescence framework proposed by Richard Jessor identifies the importance of risk behaviors in an adolescent's personal development, as these behaviors "can be instrumental in gaining peer acceptance and respect; in establishing autonomy from parents; in repudiating the norms and values of conventional authority; in coping with anxiety, frustration, and anticipation of failure; or in affirming maturity and marking a transition out of childhood and toward a more adult status."⁹ This framework highlights the role that risk behaviors play in the natural development of adolescents. In the context of adolescents with type 1 diabetes, however, these behaviors come with additional consequences. The current article describes the rates of risk behaviors in the general population, summarizes any information known about rates in adolescents with type 1 diabetes, and describes the possible effects of these behaviors on glycemic control and other health outcomes.

Substance Use

Alcohol

Although illegal before the age of 21 years, alcohol consumption is common in adolescents. As noted above, approximately 73% of high school students report having ever consumed alcohol, and 24% report having had 5 or more drinks in a row (binge drinking).¹ Similar rates have been found in older high school students with type 1 diabetes.¹⁰ For adolescents with type 1 diabetes, however, drinking alcohol can have a significant negative impact on their blood glucose levels. For example, one study found that moderately heavy alcohol consumption by adolescents with type 1 diabetes in a social setting (mean of 9 drinks for males, 6 for females—along with meals, sweetened mixers, and dancing) was associated with increased glycemic variation but not with hypoglycemia.¹¹ In adults with type 1 diabetes, consumption of alcohol has been linked with a greater number of hypoglycemic episodes the following day,^{12,13} as well as impaired ability to recognize symptoms of hypoglycemia, a potentially serious outcome.¹³ Results from these studies should be interpreted with caution, however, because of the small sample sizes ($N = 10\text{--}17$); more research is still needed to determine the patterns of alcohol use in adolescents with type 1 diabetes and the effects on self-management and blood glucose.

Tobacco

The average smoker begins at age 12 years and is a regular smoker by age 14 years; 90% of adult smokers report that they began smoking cigarettes in adolescence.¹⁴ The exact prevalence of smoking in adolescents with type 1 diabetes has not been reported, but some studies have reported that smoking among teens with a chronic condition is equal to or higher than that of adolescents without a chronic condition.^{7,15} One study asked adolescents with type 1 diabetes why they started smoking, and they reported a variety of reasons, such as a conscious decision to start and continue smoking, pure experimentation, and growing up

with parents who smoked.¹⁶ The same study found that few adolescents reported receiving advice from their health care providers regarding smoking and that many adolescents believed that their providers were not aware of their smoking.¹⁶ Note that some adolescents may use smokeless tobacco products (eg, snuff, chewing tobacco) instead of cigarettes; about 9% of high school students report using it, with rates higher among boys than girls.^{2,17}

Tobacco smoking is a leading cause of preventable death worldwide, and smoking has been linked to many serious adverse outcomes, including many types of cancer, chronic obstructive pulmonary disease, and coronary heart disease.¹⁸ In terms of metabolic outcomes, a study with a large sample of adolescents (N = 27,561) found that adolescent smokers with type 1 diabetes had higher A1C levels compared with nonsmokers.¹⁹ Smoking induces abnormal secretion of pituitary and counterregulatory hormones, and this increase in growth hormone and cortisol may lead to higher blood glucose levels, one possible explanation for the higher A1C levels.¹⁹ Further studies of adult smokers with diabetes have consistently shown that smoking is associated with microalbuminuria, diabetic nephropathy, and retinopathy.^{20,21} Although the effects of smokeless tobacco have not been studied in adolescents with type 1 diabetes, the American Heart Association recently issued a statement that smokeless tobacco products are harmful to cardiovascular health.¹⁷

Illicit Drug Use

Illicit drug use is somewhat less common than alcohol or nicotine use among adolescents; while slightly less than half of all 12th graders have ever tried illicit drugs,² only 9% of youth aged 12 to 17 years report current use.²² A recent study showed that teens with type 1 diabetes in 8th through 10th grades had a lower lifetime prevalence rate of illicit drug use (9.6% vs 22%) when compared with a national average, but by the 11th and 12th grades, the rates among adolescents with type 1 diabetes were equal to the national average.¹⁰ Another study that examined illicit drug use among adolescents and young adults (16–30 years old) with type 1 diabetes found that almost 40% of responders admitted to using illicit drugs, most frequently marijuana.²³ Note, however, that results from these studies are limited by the use of self-report questionnaires to determine prevalence of drug use, which may lead to over- or underreporting.

There appears to be a reciprocal relationship between illicit drug use and glycemic control, as adolescents with poor glycemic control are more likely to use drugs and the drugs themselves contribute to episodes of hypo- or hyperglycemia.²³ Although marijuana does not appear to have a direct effect on blood glucose,²⁴ it does impair judgment and increase appetite, which is likely to have a negative effect on self-management behaviors (eg, carbohydrate counting). Drugs such as ecstasy are associated with reported episodes of diabetic ketoacidosis.²³ Furthermore, while only 28% of adolescents report being aware of the adverse effects of illicit drug use on diabetes self-management and glycemic control, 48% report taking extra precautions when using drugs (eg, telling friends they have diabetes, conducting more frequent blood glucose checks).²³

Sexual Behaviors That Contribute to Unintended Pregnancy and Sexually Transmitted Diseases

Sexual exploration frequently begins in adolescence—as noted above, 46% of high school students report having had sexual intercourse.¹ Adolescents with type 1 diabetes may be at increased risk for unplanned pregnancy and sexually transmitted diseases; one study of adolescents with type 1 diabetes found that only half those who were sexually active used condoms or other forms of birth control²⁵ (as compared with 61% in the general population).¹ Girls with type 1 diabetes may engage in unprotected sex because they

mistakenly believe that they will have difficulty conceiving due to their diabetes.²⁶ For adolescent girls with diabetes, unplanned pregnancy comes with added adverse outcomes. Poor glycemic control before conception and early in pregnancy increases risk for maternal and fetal complications, including early pregnancy loss, obstetrical complications, ketoacidosis, hypoglycemia, and renal, ocular, and/or microvascular complications.²⁷

Although the American Diabetes Association recommends that women receive preconception counseling starting at puberty,²⁸ a recent study found that less than half of adolescents with type 1 diabetes reported discussing birth control with a health professional.²⁵ A preventive program for adolescent girls with diabetes, READY Girls, was found to increase knowledge and intention to seek preconception counseling and use effective family planning.²⁹

Eating Disorders and Insulin Omission

Disordered eating behavior is also common in adolescents, especially girls. According to the Youth Risk Behavior Surveillance, 45% of high school students reported trying to lose weight, and this percentage was higher among females than males.¹ Furthermore, 41% of students reported that they had restricted their diet, 11% reported going for 24 hours without eating, 5% reported taking diet pills, and 4% had vomited or taken laxatives in order to lose weight,¹ highlighting the prevalence of disordered eating behavior in adolescence.

In contrast to previously discussed risk behaviors, there has been a greater focus on disordered eating behaviors specifically in adolescents with type 1 diabetes in recent years. Adolescent girls with type 1 diabetes are at 2.4 higher risk than their counterparts without diabetes to have some form of an eating disorder.³⁰ Particularly alarming is the use of insulin reduction and omission for the purpose of losing weight in adolescents. This behavior is fairly common and may occur in patients who do not meet criteria for an eating disorder; it has been reported by 31% to 36% of women with type 1 diabetes.^{31,32} Insulin omission places the individual at suboptimal glycemic control and at risk for earlier complications from diabetes. Longer duration of insulin omission increases the risk for microvascular complications, including retinopathy and nephropathy, as well as mortality.³³ These findings underscore the prevalence of eating disorders and their serious consequences in adolescents with type 1 diabetes.

Clinical Implications

Research supports that risk behaviors in adolescents with type 1 diabetes can have detrimental effects on health outcomes and that adolescents often have a lack of understanding and/or misunderstanding of their personal risk related to consumption of alcohol, cigarette smoking, illicit drug use, unprotected sex, and disordered eating behaviors. It is also important to remember that many of these risk behaviors cluster. While experimentation and engagement in risk behaviors are part of normal growth and development for adolescents,⁹ diabetes educators and health care providers need to provide them with resources and knowledge to reduce their personal health risk.

Identifying Risk and Protective Factors

While there is limited research focused on identifying which adolescents with diabetes are most likely to engage in risk behaviors, findings from the general population have identified populations who are at higher risk. Table 1 describes risk and protective factors for various behaviors and the implications they have for adolescents with type 1 diabetes. Recent studies suggest that many risk factors are evident before youth reach adolescence.³ One early predictor of later risk behaviors is impulsiveness, seen as early as age 3 years³⁴ and

most common in children with attention-deficit/hyperactivity disorder. In addition, the tendency to seek out novel experiences, or *sensation seeking*, has been shown to strongly correlate with risk behaviors, such as smoking and alcohol use.³ Symptoms of depression and anxiety, low self-esteem, and the desire to please others have also been found in individuals who engage in risk behaviors, including risky sexual activity.³⁵ Although low-income and minority youth are often thought to be at greatest risk for drug and alcohol use, studies indicate that white adolescents living in suburban or middle-class households are actually more likely to drink alcohol and use illicit drugs when compared with normative samples.³⁵ In fact, African Americans have lower use of illicit drugs, alcohol, and cigarettes than white or Hispanic youth.² Finally, peers play a large role in adolescent risk-taking behavior, in that adolescents are more likely to engage in the same risk behaviors as their peer group.³

One of the most powerful protective factors against adolescent risk behaviors is regular family meals.³⁶ Adolescents who report eating dinner with their family at least 5 to 7 times per week are significantly less likely to use alcohol, tobacco, and marijuana.³⁶ Regular family meals have also been found to protect against disordered eating behaviors.³⁷ It is likely that the increased accountability of having to be home for meals, as well as the increased communication associated with family meals, provides the protective effects.³⁶ Perceived risk and availability are also factors in drug use.² For example, perceived risk for marijuana, the most commonly used illicit substance, is low: Only 52% of 12th graders perceive great risk in regular use, and it is one of the most available substances.² College plans are another protective factor—students who are college-bound are at lower risk for using drugs, drinking heavily, and smoking cigarettes.² Finally, involvement in extracurricular activities appears to be protective against drug use.²

Assessment of Risk Behaviors

Assessment of lifestyle and risk behaviors is paramount, as these behaviors are not likely to be disclosed by adolescents without direct questioning. A well-studied interview for assessing adolescent risk behavior is the HEADSSS psychosocial inventory (home, education, eating, activities, drugs, sexuality, suicide/depression, and safety),³⁸ which was modified to focus on risk behaviors most salient for adolescents with type 1 diabetes (see Table 2). Ideally, risk behavior assessments with adolescents occur privately, without parents or other adults present, to gain trust and promote honest answers. The educator or provider can explain that he or she will be asking some personal questions and that the adolescent's responses are confidential, with the exceptions clearly presented where confidentiality is to be broken (eg, if adolescents reveal they are thinking of hurting themselves). Confidentiality laws vary by state, so it is important for diabetes educators and health care providers to be aware of the laws where they practice. It is also important to respect parental values regarding these risk behaviors while still conveying important information. These conversations are best begun in early adolescence, before the child is likely to have engaged in risk behaviors.

Following the format of the HEADSSS interview, start with nonthreatening questions and progress to more personal and sensitive questions. It can be helpful to start a discussion of a potentially personal and intrusive subject by normalizing the behavior. For example, when asking about alcohol use, begin with "I know many teenagers engage in the consumption of alcohol. Does anyone at your school drink alcohol?" and proceed to "Do you know anybody or have any friends who drink? Have you ever consumed an alcoholic beverage?" When broaching these topics, avoid making assumptions and ask open-ended questions as often as possible.³⁸

Some questions specific to adolescents with type 1 diabetes are recommended. For example, insulin pump users should be asked when they take their pumps off. If the adolescent admits to being sexually active, the provider should ask whether the pump is taken off during sexual activity. It is also important to examine the bolus patterns in the pump, as it may be possible to see whether the adolescent has missed boluses. Of particular concern, the adolescent may be skipping boluses to manage his or her weight. Asking the question “Do you take less insulin than you should?” may serve as a screening tool for identifying disordered eating behaviors.³⁰ Researchers recommend early and routine screening for such problems by asking about unusually low-caloric meal plans, unexplained elevations in A1C, unexplained ketoacidosis, and possible amenorrhea.^{30,39} If problems are identified, a collaborative multidisciplinary team approach is recommended to treat the eating disorder within the context of diabetes, with the goal of establishing medical safety and normalizing eating and diabetes self-care behaviors.³⁰

Adolescents with type 1 diabetes also engage in other behaviors that may pose health risks, such as forgetting diabetes supplies (or choosing not to bring them) and skipping boluses (aside from doing so for weight control, as discussed above). These problems with adherence are common among adolescents with type 1 diabetes—with rates as high as 93%⁴⁰—and have been associated with poorer glycemic control and increased risk for medical complications.⁴¹ Adolescents report several obstacles to adherence, including the development of independence from parents, family conflict, and social concerns (eg, fitting in with peers and not wanting to stop enjoyable activities to perform diabetes tasks).⁴² Several interventions have been developed to improve adherence in adolescents with type 1 diabetes, and the most effective ones simplify and minimize the demands of treatment management while helping teens share the burden with others.⁴²

Educating Adolescents and Parents

Numerous interventions to prevent or stop adolescent risk behaviors have been studied in the general population.⁴³ While there is little research on preventive interventions for risk behaviors specifically in adolescents with type 1 diabetes, the literature from the general population is relevant. Incorporating education and direct open conversations about high-risk behaviors as part of the routine assessment at regular clinic visits is vital to prevention. A detailed examination of the family history and the adolescent’s social situation may help to identify possible risk factors for engaging in these behaviors (see Table 1). To help families build a supportive network, diabetes educators and clinicians must build partnerships among providers, adolescents, and parents; collaborate with school nurses; and refer to community and mental health resources as needed.²⁸

Educating adolescents about the effects of risk behaviors on their health is important, as is encouraging teens to surround themselves with friends who share the same values. In addition to educating adolescents about the consequences of risk behaviors, diabetes educators and providers can help teens develop skills and strategies to make good choices in the face of risky situations. Letting friends know that they have diabetes and wearing a medical identification bracelet, for example, may protect teens from some of the negative effects of drug or alcohol use. Finally, frank discussion of the medical complications associated with the use of illicit drugs, alcohol, and tobacco use may give adolescents a reason to quit. It is essential not to underestimate the importance of this discussion; one of the strongest predictors for drug use is the perception that drugs are not dangerous to one’s health.²

While it is important to have these conversations in a private session with adolescents, including the family in preventative education may be beneficial. Having a similar conversation with adolescents’ parents/caregivers may increase their awareness of the

increased risks their teens face and, hopefully, initiate further conversations at home. It is well established that continued involvement of parents in diabetes management is related to better outcomes.⁶ Diabetes educators and providers can act as cheerleaders for parents, empowering them to stay involved and set limits with their adolescents. If parents are supported by providers and educators, they may feel more comfortable talking at home with their adolescent children about risk behaviors. Studies support that parents have a large impact on adolescents' decisions to engage in risk behaviors, such as drug use and sexual activity.³⁶ The educator or provider can be a conduit in helping parents praise and acknowledge adolescents' healthy choices.

Follow-up

The lives of adolescents are fluid and dynamic, and while one day they may promise to abstain from alcohol, cigarettes, drugs, and sex, they may quickly change their minds. The most important thing that a diabetes educator or provider can do to prevent risk behaviors is assess for these behaviors regularly and tailor counseling and education accordingly. Adolescents who are not sexually active, for example, will understand preconception counseling from a perspective different from those who are active. Adolescents with type 1 diabetes are typically seen on a quarterly basis, allowing for frequent assessment of risk and protective factors and behaviors while providing education around the most relevant risk behaviors for individual adolescents. Much time and effort are spent warning and redirecting adolescents, but the positive reinforcement of congratulating them for avoiding risky behaviors may also be beneficial.

Conclusions

The paucity of the literature in this area of risk behaviors in adolescents with type 1 diabetes highlights the need for further research. Much of the research that is available is limited by extremely small sample sizes, inadequate control groups, and conflicting findings. Nonetheless, important findings have emerged that can guide diabetes educators and providers in their conversations with youth. One of the most well-studied potentially risky behaviors in teens with diabetes⁴⁴—that is, driving—may provide a model for developing guidelines and interventions to prevent risk behaviors in adolescents with type 1 diabetes. Driving is one area in which most diabetes educators and providers offer clear education and recommendation, likely because parents and providers feel more comfortable talking with teens about driving than they do about more sensitive subjects, such as sexuality or drug use.

In conclusion, assessment, education, and intervention around risk behaviors in adolescents with diabetes are all important. Ideally, assessment begins at an early age, and preventive education about risk behaviors is provided as indicated. Known risk and protective factors for these behaviors are highlighted here, but more research is needed to identify which factors are most salient for adolescents with type 1 diabetes. Many health care providers are hesitant to have these conversations because they are unsure of what to do if the adolescent admits to engaging in these behaviors. In this article, we provide suggestions for questions to help diabetes educators and providers begin these conversations. Assessing for these behaviors and intervening when necessary can decrease risks of medical complications in adolescents with type 1 diabetes and may even save their lives.

Acknowledgments

Sarah S. Jaser was supported by awards from the National Institute of Diabetes and Digestive and Kidney Diseases (K23 NK088454) and the National Center for Research Resources (UL1 RR024139).

References

1. Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance—United States, 2009. *MMWR Morb Mortal Wkly Rep*. 2010; 59:1–142. [PubMed: 20075837]
2. Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulerberg, JE. *Monitoring the Future National Results on Adolescent Drug Use: Overview of the Key Findings, 2009*. Bethesda, MD: National Institute on Drug Abuse; 2010. NIH publication 10-7583
3. Romer D. Adolescent risk taking, impulsivity, and brain development: implications for prevention. *Dev Psychobiol*. 2010; 52:263–276. [PubMed: 20175097]
4. Liese AD. The burden of diabetes mellitus among US youth: prevalence estimates from the SEARCH for Diabetes in Youth Study. *Pediatrics*. 2006; 118:1510–1518. [PubMed: 17015542]
5. Amiel SA, Sherwin RS, Simonson DC, Lauritano AA, Tambolane WV. Impaired insulin action in puberty: a contributing factor to poor glycemic control in adolescents with diabetes. *N Engl J Med*. 1986; 315:215–219. [PubMed: 3523245]
6. Anderson BJ, Vangsness L, Connell A, Butler D, Goebel-Fabbri A, Laffel L. Family conflict, adherence, and glycaemic control in youth with short duration type 1 diabetes. *Diabet Med*. 2002; 19:635–642. [PubMed: 12147143]
7. Suris JC, Michaud PA, Akre C, Sawyer SM. Health risk behaviors in adolescents with chronic conditions. *Pediatrics*. 2008; 122:1113–1118. [PubMed: 18977992]
8. Sawyer SM, Drew S, Yeo MS, Britto MT. Adolescents with a chronic condition: challenges living, challenges treating. *Lancet*. 2007; 369:1481–1489. [PubMed: 17467519]
9. Jessor R. Risk behavior in adolescence: a psychosocial framework for understanding and action. *J Adolesc Health*. 1991; 12:597–605. [PubMed: 1799569]
10. Martinez-Aguayo A, Araneda JC, Fernandez D, Gleisner A, Perez V, Codner E. Tobacco, alcohol, and illicit drug use in adolescents with diabetes mellitus. *Pediatr Diabetes*. 2007; 8:265–271. [PubMed: 17850469]
11. Ismail D, Gebert R, Vuillermin PJ, et al. Social consumption of alcohol in adolescents with type 1 diabetes is associated with increased glucose lability, but not hypoglycaemia. *Diabet Med*. 2006; 23:830–833. [PubMed: 16911618]
12. Turner BC, Jenkins E, Kerr D. The effect of evening alcohol consumption on next-morning glucose control in type 1 diabetes. *Diabetes Care*. 2001; 24:1888–1893. [PubMed: 11679452]
13. Richardson T, Thomas P, Weiss M, Kerr D. Day after the night before: Influence of evening alcohol on risk of hypoglycemia in patients with type 1 diabetes. *Diabetes Care*. 2005; 28:1801–1802. [PubMed: 15983341]
14. Hogan MJ. Diagnosis and treatment of teen drug use. *Med Clin North Am*. 2000; 84:927–966. [PubMed: 10928196]
15. Yeo MS, Sawyer SM. Chronic illness and disability. *Br Med J*. 2005; 330:721–723. [PubMed: 15790645]
16. Regbar S, Kelly KB. Missed opportunities: adolescents with a chronic condition (insulin-dependent diabetes mellitus) describe their cigarette-smoking trajectories and consider health risks. *Acta Paediatr*. 2007; 96:1770–1776. [PubMed: 18001334]
17. Piano MR, Benowitz NL, Fitzgerald GA, et al. Impact of smokeless tobacco products on cardiovascular disease: implications for policy, prevention, and treatment. A policy statement from the American Heart Association. *Circulation*. 2010; 122:1520–1544. [PubMed: 20837898]
18. US Department of Health and Human Services. *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention, Office on Smoking and Health; 2004.
19. Hofer SE, Rosenbauer J, Grulich-Henn J, et al. Smoking and metabolic control in adolescents with type 1 diabetes. *J Pediatr*. 2009; 154:20–23. [PubMed: 18804216]
20. Baggio B, Budakovic A, Vestra MD, Saller A, Bruseghin M, Fioretto P. Effects of cigarette smoking on glomerular structure and function in type 2 diabetic patients. *J Am Soc Nephrol*. 2002; 13:2730–2736. [PubMed: 12397043]

21. Scott LJ, Warram JH, Hanna LS, Laffel LMB, Ryan L, Krolewski AS. A nonlinear effect of hyperglycemia and current cigarette smoking are major determinants of the onset of microalbuminuria in type 1 diabetes. *Diabetes*. 2001; 50:2842–2849. [PubMed: 11723069]
22. Substance Abuse and Mental Health Services Administration, Office of Applied Studies. Results from the 2007 National Survey on Drug Use and Health: National Findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2008. SMA 08-4343
23. Ng RSH, Darko DA, Hillson RM. Street drug use among young patients with type 1 diabetes in the UK. *Diabet Med*. 2004; 21:295–296. [PubMed: 15008844]
24. Weil AT, Zinberg N, Nelson JM. Clinical and psychological effects of marijuana in man. *Science*. 1968; 162:1234–1242. [PubMed: 4880784]
25. Schwartz EB, Sobota M, Charron-Prochownik D. Perceived access to contraception among adolescents with diabetes: barriers to preventing pregnancy. *Diabetes Educ*. 2010; 36:489–494. [PubMed: 20332282]
26. Fennoy I. Contraception and the adolescent diabetic. *Health Education*. 1989; 20:21–23. [PubMed: 2516509]
27. Falsetti D, Charron-Prochownik D, Serelka S, et al. Condom use, pregnancy, and STDs in adolescent females with and without type 1 diabetes. *Diabetes Educ*. 2003; 29:135–143. [PubMed: 12632692]
28. American Diabetes Association. Standards of medical care in diabetes: 2011. *Diabetes Care*. 2011; 34:S11–S61. [PubMed: 21193625]
29. Charron-Prochownik D, Ferons-Hannan M, Sereika S, Becker D. Randomized efficacy trial of early preconception counseling for diabetic teens (READY-Girls). *Diabetes Care*. 2008; 31:1327–1330. [PubMed: 18411239]
30. Goebel-Fabbri AE. Disturbed eating behaviors in type 1 diabetes: clinical significance and recommendations. *Curr Diab Rep*. 2009; 9:133–139. [PubMed: 19323958]
31. Peveler RC, Bryden KS, Neil HAW, et al. The relationship of disordered eating habits and attitudes to clinical outcomes in young adult females with type 1 diabetes. *Diabetes Care*. 2005; 28:84–88. [PubMed: 15616238]
32. Polonsky WH, Anderson BJ. Insulin omission in women with IDDM. *Diabetes Care*. 1994; 17:1178–1185. [PubMed: 7821139]
33. Goebel-Fabbri AE, Fikkan J, Franko DL, Pearson K, Anderson BJ, Weinger K. Insulin restriction and associated morbidity and mortality in women with type 1 diabetes. *Diabetes Care*. 2008; 31:415–419. [PubMed: 18070998]
34. Caspi A, Silva P. Temperamental qualities at age 3 predict personality traits in young adulthood: longitudinal evidence from a birth cohort. *Child Dev*. 1995; 66:486–498. [PubMed: 7750379]
35. Luthar SS, Becker BE. Privileged but pressured? A study of affluent youth. *Child Dev*. 2002; 73:1593–1610. [PubMed: 12361321]
36. National Center on Addiction and Substance Abuse at Columbia University. The Importance of Family Dinners IV. New York, NY: National Center on Addiction and Substance Abuse at Columbia University; 2010.
37. Neumark-Sztainer D, Larson NI, Fulkerson JA, Eisenberg ME. Family meals and adolescents: what have we learned from Project EAT (Eating Among Teens)? *Public Health Nutr*. 2010; 13:1113–1121. [PubMed: 20144257]
38. Goldenring JM, Rosen DS. Getting into adolescent heads: an essential update. *Contemp Pediatr*. 2004; 21:64.
39. Olmstead MP, Colton PA, Daneman D, Rydall AC, Rodin GM. Prediction of the onset of disturbed eating behavior in adolescent girls with type 1 diabetes. *Diabetes Care*. 2008; 31:1978–1982. [PubMed: 18628570]
40. Lewin AB, La Greca AM, Geffken GR, et al. Validity and reliability of an adolescent and parent rating scale of type 1 diabetes adherence behaviors: the Self-Care Inventory (SCI). *J Pediatr Psychol*. 2009; 34:999–1007. [PubMed: 19423660]
41. Hood KK, Peterson CM, Rohan JM, Drotar D. Association between adherence and glycemic control in pediatric type 1 diabetes: a meta-analysis. *Pediatrics*. 2010; 124:1171–1179.

42. Borus JA, Laffel L. Adherence challenges in the management of type 1 diabetes in adolescents: prevention and intervention. *Curr Opin Pediatr.* 2010; 22:405–411. [PubMed: 20489639]
43. Kumpfer KL, Alvarado R. Family-strengthening approaches for the prevention of youth problem behaviors. *Am Psychol.* 2003; 58:457–465. [PubMed: 12971192]
44. Court JM, Cameron FJ, Berg-Kelly K, Swift PGF. Diabetes in adolescence. *Pediatr Diabetes.* 2009; 10:185–194. [PubMed: 19754629]

Table 1

Risk and Protective Factors and Associated Health Outcomes for Risk Behaviors

Behavior	Risk Factors	Protective Factors	Health Outcomes
Substance use	Peer group use Parental use Lack of parental monitoring Antisocial behavior Impulsiveness Sensation seeking Poor school performance Perceived availability White	Parental communication about substance use Family meals Perceived risk Involvement in extracurricular activities College plans	<i>Alcohol</i> Increased glycemic variation Increased risk for hypoglycemia Compromised ability to detect hypoglycemia <i>Cigarette smoking</i> Higher A1C Increased risk for diabetic nephropathy and retinopathy <i>Illicit drugs</i> Increased risk for hypo- or hyperglycemia Increased risk for ketoacidosis Impaired judgment compromises ability to perform self-management tasks
Unprotected sex	History of abuse Low self-esteem Lack of parental supervision Sexually active peers	Involvement in extracurricular activities College plans	Increased risk for early pregnancy and obstetrical complications Increased risk for ketoacidosis Sexually transmitted diseases
Disordered eating	Female Family history Dieting Depression, anxiety	Family meals Positive body image	Higher A1C Increased risk for diabetic nephropathy and retinopathy Higher rates of mortality

Table 2**Assessment Questions for Adolescents With Type 1 Diabetes^a**

Eating	What do you like about your body?
	What do you not like about your body?
	Are you happy with your weight?
	Has your weight gone up or down in the past year?
	Have you done anything to try to manage your weight this year? How? How often?
	What do you think is a healthy diet?
	How much exercise do you get on an average week?
	Have you ever decreased the amount of insulin you're supposed to take or skipped insulin doses to manage your weight?
Drugs, alcohol, tobacco	Do you ever skip mealtime boluses?
	Do any of your friends use tobacco? Alcohol? Other drugs?
	Does anyone in your family use tobacco? Alcohol? Other drugs?
	Do you use tobacco? Alcohol? Other drugs?
	Do you adjust your insulin when drinking? When using other drugs?
Sexuality	Is there any history of alcohol or drug problems in your family?
	Do you have a boyfriend or girlfriend?
	Have you ever had sex? If yes, how many people have you had sex with?
	What does the term <i>safe sex</i> mean to you?
	Have you ever been pregnant or worried you may be pregnant?
	Do you use condoms every time you have intercourse?
	Have you ever been forced to have sex against your will?
	Do you disconnect your insulin pump during sexual activity?

^a Adapted from HEADSSS interview.³⁸