Impulse Control, Diabetes-Specific Self-Efficacy, and Diabetes Management Among Emerging Adults With Type 1 Diabetes

Nathan W. Stupiansky,[1] PhD, Kathleen M. Hanna,[2] PhD, RN, James E. Slaven,[3] MS, MA, Michael T. Weaver,[4] PhD, RN, and J. Dennis Fortenberry,[1] MD, MS

[1]*Section of Adolescent Medicine, Indiana University School of Medicine,* [2]*Indiana University School of Nursing, Family Health Department,* [3]*Division of Biostatistics, Indiana University School of Medicine, and* [4]*Indiana University School of Nursing, Environments for Health Department*

All correspondence concerning this article should be addressed to Kathleen M. Hanna, PhD, RN, Indiana University School of Nursing, 1111 Middle Dr, NU 451, Indianapolis, IN 46202, USA. E-mail: kathanna@iupui.edu

Received December 6, 2011; revisions received and accepted September 26, 2012

Objective To explore the relationships among impulse control, diabetes-specific self-efficacy, and diabetes management behaviors among emerging adults with type 1 diabetes. **Methods** A total of 204 high school seniors ($M = 18.25$ years, $SD = .45$, 55.9% females) with type 1 diabetes self-reported on impulse control, diabetes-specific self-efficacy, and diabetes management behaviors during the past 3 months. Mediation and path analyses were used to address aims. **Results** Greater impulse control was associated with better diabetes management among these emerging adults. In addition, diabetes-specific self-efficacy partially mediated the relationship between impulse control and diabetes management. **Conclusions** Impulse control and diabetes-specific self-efficacy may be important in the management of type 1 diabetes among emerging adults. Diabetes-specific self-efficacy may play an important role in successful diabetes management among youth with lower impulse control.

Key words adolescents; diabetes; health behavior.

The developmental period of emerging adulthood is considered a critical time for those with type 1 diabetes (Peters & Lafell, 2011; Weissberg-Benchell, Wolpert, & Anderson, 2007), and this period is known for poor diabetes outcomes (Wysocki, Hough, Ward, & Green, 1992). Emerging adulthood is marked by increasing freedom (Arnett, 2000) and by numerous transitional events such as leaving the parental home or attending college (Arnett, 2000; Furstenberg, Rumbaut, & Settersten, 2005). This transitional period is proposed to be challenging relative to potential indicators of success or difficulties reflected in diabetes outcomes (Hanna, 2011). Indeed, the diabetes outcome of glycemic control declines during this period (Bryden et al., 2001; Insabella, Grey, Knafl, & Tamborlane, 2007) and is linked to diabetes management (Hood, Peterson, Rohan, & Drotar, 2009). Studies have confirmed that diabetes management is important to target when trying to maintain glycemic control during challenging transitions known to disrupt diabetes care routines (Balfe, 2009; Ramchandani et al., 2000).

Diabetes management is proposed to be associated with impulse control in the emerging adulthood framework guiding this study (Hanna, 2011). Impulse control is the ability to delay gratification to achieve goals (Casey, Getz, & Galvan, 2008), the inhibitory control element of executive functioning (Garner, 2009), and particularly important developmentally during emerging adulthood (Steinberg, 2008). This developmental cognitive process is associated with biological changes in the prefrontal cortex, which is immature into the mid to late 20 s (Casey et al., 2008). Developmental changes occur in the balance between impulsivity and impulse control during the transition from adolescence into young adulthood (Steinberg, 2007). Impulsivity, the tendency to put greater emphasis

Journal of Pediatric Psychology 38(3) pp. 247–254, 2013
doi:10.1093/jpepsy/jss110
Advance Access publication October 31, 2012

on rewards related to immediate outcomes, occurs due to motivated reward-seeking in the absence of impulse control, the ability to value a delayed, potentially larger reward (Monterosso & Ainslie, 1999; Solnick, Kannenberg, Eckerman, & Waller, 1980). Impulsivity implies heightened reactivity to proximal cues, which may compete with behaviors relative to outcomes that may seem equivocal and distal (Steinberg, 2007; Steinberg et al., 2008). For example, in the case of diabetes management, an emerging adult enrolled in college might be distracted by proximal cues related to a social event and forget about checking his or her blood glucose level, which is needed for the distal outcome of glycemic control. Support for the importance of this developmental process to health behaviors is documented in the general youth literature indicating that less self-control is associated with behaviors that risk one's health (Patock-Peckham, Cheong, Balhorn, & Nagoshi, 2001; Piquero, Gibson, & Tibbetts, 2002; Steinberg, 2008; Tangney, Baumeister, Boone, 2004). Further, executive functioning has been reported to be associated with diabetes management among youth with type 1 diabetes (McNally, Rohan, Pendley, Delemater, & Droter, 2010; Graziano et al., 2011), supporting the importance of cognitive functioning for youth with diabetes. However, impulse control has garnered less attention for its relationship with diabetes management.

Diabetes management is also proposed to be associated with diabetes-specific self-efficacy in this emerging adulthood framework (Hanna, 2011). Self-efficacy is one's perceived confidence in one's abilities to perform specific behaviors (Bandura, 1997), in this case, diabetes management. This individual characteristic is assumed to be especially salient for these autonomous youth (Hanna, 2011) who have great freedom (Arnett, 2000) and primary responsibility for diabetes care (Hanna et al., 2011). Indeed, diabetes self-efficacy is well-known to be associated with diabetes management among youth with diabetes (Berg et al., 2011; Helgeson, Honcharuk, Becker, Escobar, & Siminerio, 2011; Iannotti et al., 2006; Johnston-Brooks, Lewis, & Garg, 2002; Ott, Greening, Palardy, Holderby, & DeBell, 2000; Stewart et al., 2003). In addition, diabetes self-efficacy is considered an important variable to target in interventions to improve management (Iannotti et al., 2006) and may be particularly important for youth in this developmental period. Impulse control, a neurocognitive developmental process (Steinberg et al., 2008), may be a challenging factor on which to intervene; however, diabetes management may be amenable to interventions through self-efficacy, a learned behavior (Bandura, 1977).

From a social cognitive perspective, diabetes-specific self-efficacy may represent a mechanism to ''balance'' the demands of diabetes management and the enhanced sensation-seeking and impulsivity associated with the transition from adolescence to adulthood. For example, when emerging adults with lower impulse control are introduced to a new situation with novel proximal cues, they may be especially challenged in their diabetes management. This, in turn, may lead them to develop poor diabetes-specific self-efficacy and negatively impact their diabetes management. On the other hand, youth with high self-control may have had greater success in managing diabetes in the past and developed greater confidence in their skills, which serve them well in managing diabetes in novel (for them) social situations such as a fraternity party. This suggests a model in which diabetes-related self-efficacy mediates the relationship between impulse control and diabetes management. Although no studies have been conducted looking specifically at relationships among impulse control, diabetes-specific self-efficacy, and diabetes management behavior, there is evidence suggesting such an inter-relationship in other youth behaviors. For example, self-efficacy has been found to fully mediate the relationship between impulsivity and marijuana use among youth, with higher levels of self-efficacy reducing the association of impulsivity to marijuana use (Hayaki et al., 2011).

Because there is little research in the diabetes area on the relationships among developmental cognitive processes, specifically impulse control, diabetes self-efficacy, and diabetes management, this is an exploratory study. The purposes of this study were to (a) examine the relationship between impulse control and diabetes management and (b) test diabetes-specific self-efficacy as a mediator of this relationship. A better understanding of these relationships may inform diabetes management interventions around diabetes-specific self-efficacy and impulse control, salient for youth during this developmental period.

Methods

Study Design

This report is on baseline data collected as part of a longitudinal study on the transition to young adulthood among adolescents with type 1 diabetes. Because the cross-sectional relationships among impulse control, diabetes-specific self-efficacy, and diabetes management have not yet been established, this exploratory study used baseline data before examining this in a longitudinal manner. Further, baseline data, before graduating from high school, moving out of parental homes, and enrolling in college or beginning employment, were used to control for the influence of transitional events common for this age-group (Arnett, 2000; Furstenberg et al., 2005).

Participants and Procedure

Youth in the early years of emerging adulthood (17–19 years old) with type 1 diabetes were recruited in their senior year of high school. Inclusion criteria were as follows: diagnosis of type 1 diabetes for at least 1 year, able to speak and read English, in the last 6 months of high school, and living with a parent or guardian. Exclusion criteria were diagnosis of psychiatric disorder or other condition that would interfere with diabetes management or the potential for independence from parents. Participants were recruited from outpatient diabetes clinics staffed by medical school faculty, from a private hospital outpatient clinic, and from a regional diabetes care center. Patients and their parents received a letter and/or a flier from their primary diabetes physician. Enrollment was either face to face in the clinic or via telephone. The study received Institutional Review Board approval, and written consents/assents were obtained (youth consent for those aged $\geq$18 years and parental/guardian consent/youth assent for those aged <18 years of age). For completion of baseline data collection, monetary incentives of $50 were provided to the participants. The participation rate was 85%, and those who refused were more likely to be younger ($p < .01$), male ($p = .03$), and African American ($p < .01$).

Participant Characteristics

A total of 204 participants provided complete information on impulse control, diabetes-specific self-efficacy, and diabetes management. Sample characteristics are described in Table I. The mean (standard deviation) participant age was 18.25 years (.45), with an average duration since being diagnosed with diabetes of 8.45 years (3.96) and a mean glycosolated hemoglobin (HbA1c) level of 8.98% (1.76). The sample had a higher proportion of females (55.9%) and was mostly white (92.7%). Most of the participants' parents were married (60.8%). Most fathers had at least a high school diploma (92.5%), with 38.5% holding a bachelor's or higher degree. Most mothers also had at least a high school diploma (95.6%), with 33.0% holding a bachelor's or higher degree.

Table I. *Sociodemographic and Diabetes-Related Characteristics (N = 204)*

Characteristics of youth	Number (%)
Gender	
Female	114 (55.9)
Male	90 (44.1)
Race	
African American	11 (5.4)
White	189 (92.7)
Other	4 (2.0)
Insulin administration	
Pump	95 (46.6)
Injection	109 (53.4)
Insurance status	
Private/Commercial	129 (65.8)
Public – Medicaid	26 (13.3)
Other	41 (20.9)
Diabetes management regimen	
Conventional	13 (6.4)
Flexible	191 (93.6)
Characteristics of parents	
Parents' marital status	
Married	124 (60.8)
Divorced	55 (27.0)
Never married	11 (5.4)
Separated	6 (2.9)
One or both dead	8 (3.9)
Father's education	
<12 years	15 (7.5)
High school	91 (45.5)
Two-year degree	17 (8.5)
Four-year degree	50 (25.0)
Graduate degree	27 (13.5)
Mother's education	
<12 years	9 (4.4)
High school	92 (45.3)
Two-year degree	35 (17.2)
Four-year degree	45 (22.2)
Graduate degree	22 (10.8)

Measures

Participants self-completed questionnaires, collected predominately by Web-based entry ($N = 138$). However, for those who chose not to use a computer ($N = 66$), paper copies were mailed, and self-addressed stamped envelopes were provided for their return. Participants who completed measures via paper and pencil did not statistically (>.05) differ in age, gender, fathers' education level, or insurance status from those who completed via the Web-based program. However, these two groups of participants did statistically differ (<.05) in race, parents' marital status, mothers' education level, HbA1c, and insulin administration. More of those using paper and pencil were African American, had poorer glycemic control, and had less use of pumps as the method of insulin administration, whereas more of their parents were divorced, and their mothers had lower levels of education. Owing to the underlying differences between paper-based and Internet-based respondents, a propensity score for type of data completion (Web vs. paper) was calculated from the variables of race, parents' marital status, mothers' education level, HbA1c, and insulin administration (injection vs. pump).

Sociodemographic and Diabetes-Related Data

Participants were asked to self-report their age, gender, and race/ethnicity, as well as parents' education and marital status. Because the larger study is a longitudinal field study of the natural transition to young adulthood, glycemic control (HbA1c) was assessed using assays obtained from medical records from participants' current health care provider. Adjusted HbA1c values were calculated by taking the original HbA1c value and subtracting the bias as determined by the College of American Pathologists survey data (www.ngsp.org/CAP). The bias value is unique to the assay method and thus normalizes all values by the exact assay used at the clinics. Although the intent was for assays reflecting the past 3 months, 20% of the sample did not have an HbA1c value available during this 3-month window, which is typical of this age group that is known to not have consistent 3-month appointments (Wysocki et al., 1992). For this group, we used the closest HBA1c in this report because we are using it to describe the sample and not to predict HbA1c. The median time interval from HbA1c assessment date to baseline data collection was 42.9 days ($SD = 82.3$).

Diabetes Management

Diabetes management was measured by the Emerging Adult Diabetes Management Self-Report developed for this study, which measures 24 management tasks related to diet, exercise, blood glucose testing, insulin administration, and hypoglycemia management for both conventional and flexible regimens. This measure is an adaptation of the Diabetes Self-Management Profile (DSMP) (Harris et al., 2000) from an interview format for use with adolescents to a self-report for cognitively mature emerging adults. Participants were asked to respond to how often they performed certain tasks or what changes were made to their regimen, given specific situations during the past 3 months. Responses were summed providing a potential range of 0–84 for total management, with higher scores indicating better overall management. The original DSMP and recently published self-report adaptations have been shown to be valid, with a documented relationship with glycemic control (Harris et al., 2000; Markowitz et al., 2011; Wysocki, Buckloh, Antal, Lochrie, & Taylor, 2011). Good reliability has been demonstrated for the original DSMP total management scale (Cronbach alpha = .77) and for the self-report scale in the current study (Cronbach alpha = .81).

The Diabetes-Specific Self-Efficacy Scale

The Diabetes-Specific Self-Efficacy Scale (Littlefield et al., 1992) measured youth's confidence in their abilities to perform seven diabetes management tasks related to diet, glucose monitoring, insulin administration, and exercise. For this study, the scale was revised, adding an eighth item to differentiate managing hypoglycemia and hyperglycemia, as well as to reflect contemporary treatment. Participants were asked to grade themselves on how well they could do the tasks, ranging from an "A+" designating "*could not do better*" to an "F" designating "*you are a disaster*." The responses were summed for a total score that could range from 8 to 72, with higher scores indicating better self-efficacy. The scale has been shown to be reliable, with a Cronbach alpha of .78 for the seven-item scale reported by the developers (Littlefield et al., 1992). With this sample, the Cronbach alpha was .85 for the eight-item scale.

Impulse Control

Impulse control was measured by the Impulse Control subscale of the Self-regulation Questionnaire (Neal & Carey, 2005). This 11-item subscale measures the respondents' delay of gratification or inhibitory control in relation to actions, decisions, and plans. Respondents were asked to respond with the degree to which the statement described them from *strongly disagree* (1) to *strongly agree* (5). Items reflecting lack of abilities were reverse scored. Then, impulse score responses were summed for a total score, with a potential range of 11–55 and higher scores reflecting greater control. The developers reported good reliability, with an alpha of .84 in a sample of college students and validity shown by a positive correlation with Rosenbaum's (1980) measure of self-control and a negative correlation with Eysenck and colleagues' (1985) impulsivity measure (Neal & Carey, 2005). The Cronbach alpha was .86 with the sample in this study.

Statistical Analysis

To test for the association of impulse control with diabetes management and the possible mediating effect of self-efficacy, path analysis methods were used. These analyses were used to test for direct and indirect (mediating) effects of the independent and mediating variables. All variables were used in their continuous form.

Since testing mediation using path analysis is a newer method than Baron and Kenny's (1986) method, Baron and Kenny's analysis steps (Hayes, 2009) were used to confirm the path analytic results. We follow Baron and Kenny's four steps: (1) show that there is a significant association between the outcome and predictor variables using regression analysis, (2) show that there is a significant association between the predictor and mediating variable using regression analysis, (3) use regression analysis with both the predictor and mediating variable on the outcome variable, and (4) show that the mediating variable causes the association between the predictor and outcome variable to become either non-significant (for complete mediation) or less significant (for partial mediation).

Respondents who used paper-based questionnaires differed from those choosing Web-based responses on race, parents' marital status, mothers' education level, HbA1c, and insulin administration (injection vs. pump). One way to control for those differences would be to include those five variables in the regression model. However, sample size was not large enough to support inclusion of an additional five covariates. As an alternative, those five variables were incorporated into a logistic regression model to estimate probability of use of a paper-based questionnaire. That estimated probability, also referred to as a propensity score, of using a paper-based questionnaire was then incorporated as a covariate within the regression model to control for the potential influence of those five extraneous variables on the outcome variable. Use of propensity scores is a commonly used method to control for multiple extraneous factors while preserving degrees of freedom and power (Klungel et al., 2004).

Conformance to statistical assumptions was tested for all models. Proc Tcalis was used for the path analysis. All analyses were performed using SAS v9.2, SAS Institute, Cary, NC.

Results

The augmented correlation matrix used for the path analysis is provided in Table II. Correlations ranged from .47 to .71, with all correlations being statistically significant at $p < .001$. Figure 1 presents the model and path analysis results. As the model was saturated, model fit was perfect. Statistically significant, positive direct effects were identified for impulse control on both diabetes-specific self-efficacy and diabetes management, as well as a direct effect for diabetes-specific self-efficacy on diabetes management. A statistically significant indirect effect was found for impulse control on diabetes management operating through self-efficacy (indirect effect = .35, $p < .001$). The presence of both direct and indirect effects for impulse control indicates partial mediation.

Using Baron and Kenny's method, both impulse control (predictor) and diabetes-specific self-efficacy (mediator) are significantly associated with diabetes management in the bivariate models ($p < .001$ for both). Multivariate regression, with both impulse control and diabetes-specific self-efficacy in the model, shows a continued significant association between diabetes management and self-efficacy ($p < .001$), but not between diabetes management and impulse control ($p = .053$), indicating complete mediation.

Table II. *Augmented Correlation Matrix Used for Path Analysis*

	Impulse control	Diabetes-specific self-efficacy	Diabetes management
Impulse control	1.00		
Diabetes-specific self-efficacy	0.55	1.00	
Diabetes management	0.47	0.71	1.00
Mean	41.19	52.86	49.88
Variance	52.70	133.72	134.62

The path analysis method agrees with the Baron and Kenny method, both indicating that diabetes-specific self-efficacy mediates the relationship between impulse control and diabetes management. The path model suggests partial mediation, as the impulse control → diabetes management direct effect was significant ($p = .0496$), whereas the Baron and Kenny model suggests complete mediation ($p = .0526$), but the associations are very similar.

Discussion

These findings extend existing evidence on the importance of cognitive functioning for diabetes management (Graziano et al., 2011; McNally et al., 2010) by providing insight into a specific cognitive process for this developmental period. Our findings suggest that emerging adults with type 1 diabetes who have low impulse control may experience difficulties with diabetes management. This finding is consistent with the evidence on the association of poor impulse control with other behaviors that risk one's health (Hayaki et al., 2011; Steinberg, 2008; Tangney et al., 2004; Patock-Peckham et al., 2001; Piquero, 2002). In addition, our results show that the association between impulse control and diabetes management behaviors is partially mediated by diabetes-specific self-efficacy. This reinforces the importance of diabetes self-efficacy demonstrated in other studies of youth with diabetes (Berg et al., 2011; Helgeson et al., 2011; Iannotti et al., 2006; Johnston-Brooks et al., 2002; Ott et al., 2000; Stewart et al., 2003). Importantly, this finding is consistent with findings that self-efficacy was a mediator between impulse control and another health behavior (Hayaki et al., 2011).

The findings from this study suggest a need for further studies during this developmental period known for instability (Arnett, 2000; Furstenberg et al., 2005). Longitudinal studies could examine how changes in living and

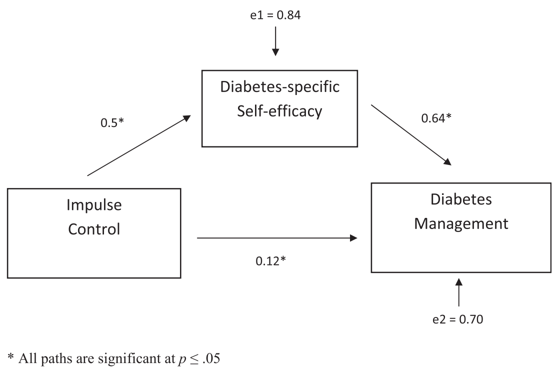

Figure 1. Path analysis. *All paths are significant at $p \leq .05$.

educational situations influence diabetes management in relation to impulse control and diabetes-specific self-efficacy. Previous research suggests that changes in living situations interface with diabetes outcomes (Hanna et al., 2011). Parent–youth relationships and parental involvement, known to be influential to diabetes outcomes (Anderson et al., 2002; Berg et al., 2011; Helgeson, Reynolds, Siminerio, Escobar, & Becker, 2007; Wysocki et al., 2009), also could be examined in association with impulse control, self-efficacy, and management among youth with diabetes. Finally, research is advocated to determine whether interventions targeting self-efficacy for those with lower impulse control can be successful in maintaining or improving diabetes management.

Several limitations to this study should be considered. First, findings only can be generalized to similar populations of emerging adults with type 1 diabetes: predominately Caucasian; living with parents who are married and have at least a high school education or beyond; and in relatively poor glycemic control, not meeting the American Diabetes Association goal of a HbA1c of <7.5% (Silverstein et al., 2005). These cross-sectional data, taken from part of a larger, longitudinal study on the transition of young adults with diabetes, only captured baseline measures. Both impulse control and diabetes-specific self-efficacy may be susceptible to change over time and to changes in living and educational situations, and these individuals may learn ways to adapt over time. Additionally, these data were self-reported, and we did not seek validation from cross-informant sources. Nonetheless, this study offers insight into a potential explanation for diabetes management based on impulse control and diabetes-specific self-efficacy.

Once there are more findings in this area, health care professionals working with emerging adults could consider self-efficacy and impulse control in their transition planning. Emerging adults with diabetes could be assessed for their level of impulse control and self-efficacy, as those with lower impulse control and self-efficacy may experience difficulties with diabetes management. Health care professionals potentially could also incorporate strategies, such as role playing, to increase self-efficacy (Bandura, 1997), especially for those with low impulse control.

Funding

The project was supported by R01NR009810 (PI KM Hanna) from the National Institute of Nursing Research. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Nursing Research or the National Institutes of Health.

Conflicts of interest: None declared.

References

Anderson, B. J., Vangsness, L., Connell, A., Butler, D., Goebel-Fabbri, A., & Laffel, L. M. (2002). Family conflict, adherence, and glycaemic control in youth with short duration type 1 diabetes. *Diabetic Medicine, 19*(8), 635–642. doi:10.1046/j.1464-5491.2002.00752.x

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*(5), 469–480. doi:10.1037/0003-066X.55.5.469

Balfe, M. (2009). Healthcare routines of university students with type 1 diabetes. *Journal of Advanced Nursing, 65*(11), 2367–2375. doi:10.1111/j.1365-2648.2009.05098.x

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. doi:10.1037/0033-295x.84.2.191

Bandura, A. (1997). *Self-efficacy: The Exercise of Control*. New York, NY: WH Freeman & Co.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182. doi:10.1037/0022-3514.51.6.1173

Berg, C. A., King, P. S., Butler, J. M., Pham, P., Palmer, D., & Wiebe, D. J. (2011). Parental involvement and adolescents' diabetes management: The mediating role of self-efficacy and externalizing and internalizing behaviors. *Journal of Pediatric Psychology, 36*(3), 329–339. doi:10.1093/jpepsy/jsq088

Bryden, K. S., Peveler, R. C., Stein, A., Neil, A., Mayou, R. A., & Dunger, D. B. (2001). Clinical and psychological course of diabetes from adolescence to young adulthood. *Diabetes Care, 24*(9), 1536–1540. doi:10.2337/diacare.24.9.1536

Casey, B. J., Getz, S., & Galvan, A. (2008). The adolescent brain. *Developmental Review, 28*, 62–77. doi:10.1016/j.dr.2007.08.003

Eysenck, S. B. G., Easting, G., & Pearson, P. R. (1985). Age norms for impulsiveness, venturesomeness and empathy in children. *Personality and Individual Differences, 5*(3), 315–321. doi:10.1016/0191-8869(84)90070-9

Furstenberg, F. F. Jr., Rumbaut, R. C., & Settersten, R. A. Jr. (2005). On the Frontier of Adulthood: Emerging Themes and New Directions. In R. A. Settersten, F. F. Furstenberg, & R. G. Rumbaut (Eds.), *On the Frontier of Adulthood: Theory, Research, and Public Policy* (pp. 3–25). Chicago, IL: The University of Chicago Press.

Garner, J. K. (2009). Conceptualizing the relations between executive functions and self-regulated learning. *The Journal of Psychology, 14*, 405–426. doi:10.3200/JRLP.143.4.405-426

Graziano, P. A., Geffken, G. R., Williams, L. B., Lewin, A. B., Duke, D. C., Storch, E. A., & Silverstein, J. H. (2011). Gender differences in the relationship between parental report of self-regulation skills and adolescents' management of type 1 diabetes. *Pediatric Diabetes, 12*(4), 410–418. doi:10.1111/j.1399-5448.2010.00692.x

Hanna, K. M. (2011). A framework for the youth with type 1 diabetes during the emerging adulthood transition. *Nursing Outlook*. Advance online publication. doi:10.1016/j.outlook.2011.10.005

Hanna, K. M., Weaver, M. T., Stump, T. E., DiMeglio, L. A., Miller, A. R., Crowder, S., & Fortenberry, J. D. (2011). Initial findings: Primary diabetes care responsibility among emerging adults with type 1 diabetes post high school and move out of parental home. *Child: Care, Health and Development*. Advance online publication. doi:10.1111/j.1365-2214.2011.01320.x

Harris, M. A., Wysocki, T., Sadler, M., Wilkinson, K., Harvey, L. M., Buckloh, L. M., . . . White, N. H. (2000). Validation of a structured interview for the assessment of diabetes self-management. *Diabetes Care, 23*(9), 1301–1304. doi:10.2337/diacare.23.9.1301

Hayaki, J., Herman, D. S., Hagerty, C. E., de Dios, M. A., Anderson, B. J., & Stein, M. D. (2011). Expectancies and self-efficacy mediate the effects of impulsivity on marijuana use outcomes: An application of the acquired preparedness model. *Addictive Behaviors, 36*(4), 389–396. doi:10.1016/j.addbeh.2010.12.018

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millenium. *Communication Monographs, 76*(4), 408–420. doi:10.1080/03637750903310360

Helgeson, V. S., Honcharuk, E., Becker, D., Escobar, O., & Siminerio, L. (2011). A focus on blood glucose monitoring: Relation to glycmeic control and determinants of frequency. *Pediatric Diabetes, 12*, 25–30. doi:10.1111lj.1399-5448.2010.00663.x

Helgeson, V. S., Reynolds, K. A., Siminerio, L., Escobar, O., & Becker, D. (2007). Parent and adolescent distribution of responsibility for diabetes self-care: Links to health outcomes. *Journal of Pediatric Psychology, 33*(5), 497–508. doi:10.1093/jpepsy/jsm081

Hood, K. K., Peterson, C. M., Rohan, J. M., & Drotar, D. (2009). Association between adherence and glycemic control in pediatric type 1 diabetes: A meta-analysis. *Pediatrics, 24*(6), 1171–1179. doi:10.1542/peds.2009-0207

Iannotti, R. J., Schneider, S., Nansel, T. R., Haynie, D. L., Plotnick, L. P., Clark, L. M., . . . Simons-Morton, B. (2006). Self-efficacy, outcome expectations, and diabetes self-management in adolescents with type 1 diabetes. *Journal of Developmental and Behavioral Pediatrics, 27*(2), 98–105. doi:10.1097/00004703-200604000-00003

Insabella, G., Grey, M., Knafl, G., & Tamborlane, W. (2007). The transition to young adulthood in youth with type 1 diabetes on intensive treatment. *Pediatric Diabetes, 8*(4), 228–234. doi:10.1111/j.1399-5448.2007.00266.x

Johnston-Brooks, C. H., Lewis, M. A., & Garg, S. (2002). Self-efficacy impacts self-care and HbA1c in young adults with type I diabetes. *Psychosomatic Medicine, 64*(1), 43–51.

Klungel, O. H., Martens, E. P., Psaty, B. M., Grobbee, D. E., Sullivan, S. D., Stricker, B. H. C., & de Boer, A. (2004). Methods to assess intended effects of drug treatment in observational studies are reviewed. *Journal of Clinical Epidemiology, 57*(12), 1223–1231. doi:10.1016/j.jclinepi.2004.03.011

Littlefield, C. H., Craven, J. L., Rodin, G. M., Daneman, D., Murray, M. A., & Rydall, A. C. (1992). Relationship of self-efficacy and binging to adherence to diabetes regimen among adolescents. *Diabetes Care, 15*(1), 90–94. doi:10.2337/diacare.15.1.90

Markowitz, J. T., Laffel, L. M. B., Volkening, L. K., Anderson, B. J., Nansel, T. R., Weissberg-Benchell, J., & Wysocki, T. (2011). Validation of an abbreviated adherence measure for young people with type 1 diabetes. *Diabetic Medicine, 28*, 1113–1117. doi:10.1111/j.1464-5491.2011.03321.x

McNally, K., Rohan, J., Pendley, J. S., Delamater, A., & Drotar, D. (2010). Executive functioning, treatment adherence, and glycemic control in children with type 1 diabetes. *Diabetes Care, 33*(6), 1159–1162. doi:10.2337/dc09-2116

Monterosso, J., & Ainslie, G. (1999). Beyond discounting: Possible experimental models of impulse control. *Psychopharmacology, 146*(4), 339–347. doi:10.1007/pl00005480

Neal, D. J., & Carey, K. B. (2005). A follow-up psychometric analysis of the self-regulation questionnaire. *Psychology of Addictive Behaviors, 19*(4), 414–422. doi:10.1037/0893-164x.19.4.414

Ott, J., Greening, L., Palardy, N., Holderby, A., & DeBell, W. K. (2000). Self-efficacy as a mediator variable for adolescents' adherence to treatment for insulin-dependent diabetes mellitus. *Children's Health Care, 29*(1), 47–63. doi:10.1207/s15326888chc2901_4

Patock-Peckham, J. A., Cheong, J., Balhorn, M. E., & Nagoshi, C. T. (2001). A social learning perspective: A model of parenting styles, self-regulation, perceived drinking control, and alcohol use and problems. *Alcoholism: Clinical and Experimental Research, 25*(9), 1284–1292. doi:10.1111/j.1530-0277.2001.tb02349.x

Peters, A., & Laffel, L. (2011). Diabetes care for emerging adults: Recommendations for transition from pediatric to adult diabetes care systems. *Diabetes Care, 34*, 2477–2485. doi:10.2337/dc11-1723

Piquero, A. R., Gibson, C. L., & Tibbetts, S. G. (2002). Does self-control account for the relationship between binge drinking and alcohol-related behaviours? *Criminal Behaviour and Mental Health, 12*(2), 135–154. doi:10.1002/cbm.492

Ramchandani, N., Cantey-Kiser, J. M., Alter, C. A., Brink, S. J., Yeager, S. D., Tamborlane, W. V., & Chipkin, S. R. (2000). Self-reported factors that affect glycemic control in college students with type 1 diabetes. *The Diabetes Educator, 26*(4), 656–666. doi:10.1177/014572170002600413

Rosenbaum, M. (1980). A schedule for assessing self-control behaviors: Preliminary findings. *Behavior Therapy, 11*(1), 109–121. doi:10.1016/s0005-7894(80)80040-2

Silverstein, J., Klingensmith, G., Copeland, K., Plotnick, L., Kaufman, F., Laffel, L., . . . Clark, N.; American Diabetes Association. (2005). Care of children and adolescents with type 1 diabetes. *Diabetes Care, 28*(1), 186–212. doi:10.2337/diacare.28.1.186

Solnick, J. V., Kannenberg, C. H., Eckerman, D. A., & Waller, M. B. (1980). An experimental analysis of impulsivity and impulse control in humans. *Learning and Motivation, 11*(1), 61–77. doi:10.1016/0023-9690(80)90021-1

Steinberg, L. (2007). Risk taking in adolescence. *Current Directions in Psychological Science, 16*(2), 55–59. doi:10.1111/j.1467-8721.2007.00475.x

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*, 78–106. doi:10.1016/j.dr.2007.08.002

Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology, 44*(6), 1764–1778. doi:10.1037/a0012955

Stewart, S. M., Lee, P. W. H., Waller, D., Hughes, C. W., Low, L. C. K., Kennard, B. D., & Huen, K. F. (2003). A follow-up study of adherence and glycemic control among Hong Kong youths with diabetes. *Journal of Pediatric Psychology, 28*(1), 67–79. doi:10.1093/jpepsy/28.1.67

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*(2), 271–324. doi:10.1111/j.0022-3506.2004.00263.x

Weissberg-Benchell, J., Wolpert, H., & Anderson, B. J. (2007). Transitioning from pediatric to adult care. *Diabetes Care, 30*(10), 2441–2446. doi:10.2337/dc07-1249

Wysocki, T., Buckloh, L. M., Antal, H., Lochrie, A., & Taylor, A. (2011). Validation of a self-report version of the diabetes self-management profile. *Pediatric Diabetes, 13*, 438–443. doi:10.1111/j.1399-5448.2011.00823.x

Wysocki, T., Hough, B. S., Ward, K. M., & Green, L. B. (1992). Diabetes mellitus in the transtion to adulthood: Adjustment, self-care, and health status. *Developmental and Behavioral Pediatrics, 13*(3), 194–201. doi:10.1097/00004703-199206000-00007

Wysocki, T., Nansel, T. R., Holmbeck, G. N., Chen, R., Laffel, L., & Anderson, B. J. (2009). Collaborative involvement of primary and secondary caregivers: Associations with youths' diabetes outcomes. *Journal of Pediatric Psychology, 34*(8), 869–881. doi:10.1093/jpepsy/jsn136