Current Diabetes Reports (2018) 18: 23
https://doi.org/10.1007/s11892-018-0995-3

PSYCHOSOCIAL ASPECTS (SS JASER, SECTION EDITOR)

Self- and Social-Regulation in Type 1 Diabetes Management During Late Adolescence and Emerging Adulthood

Deborah J. Wiebe[1] · Cynthia A. Berg[2] · Daniel Mello[1] · Caitlin S. Kelly[2]

Published online: 21 March 2018

Abstract

Purpose of Review This paper aims to examine how self-regulation (i.e., cognition, emotion) and social-regulation (i.e., parents, friends, romantic partners) are interrelated risk and protective factors for type 1 diabetes management during late adolescence and emerging adulthood.

Recent Findings Problems in cognitive (e.g., executive function) and emotional (e.g., depressive symptoms) self-regulation are associated with poorer management, both at the between- and within-person levels. Better management occurs when parents are supportive and when individuals actively regulate the involvement of others (e.g., seek help, minimize interference). Friends both help and hinder self-regulation, while research on romantic partners is limited.

Summary Facets of self- and social-regulation are important risk and protective factors for diabetes management during emerging adulthood. At this time when relationships are changing, the social context of diabetes may need to be regulated to support diabetes management. Interventions targeting those with self-regulation problems and facilitating self- and social-regulation in daily life may be useful.

Keywords Self-regulation · Executive function · Depression · Social relationships · Emerging adults · Type 1 diabetes

Introduction

The transition period from late adolescence to emerging adulthood (18–30 years) has been characterized as a high-risk time for managing type 1 diabetes (T1D). In the years following high school, emerging adults experience uncertainty as they explore future options, move out of their parents' home, enter college or join the work force, transfer from pediatric to adult care, and assume more responsibility for managing T1D [1, 2]. These many transitions may contribute to findings that less than one third of emerging adults meet recommendations for self-care and glycemic control, and many experience the beginning of microvascular complications [2]. However, longitudinal studies suggest that individuals vary greatly in their trajectories of glycemic control across this transition, with some showing deterioration across adolescence that continues into emerging adulthood, others reaching a plateau in late adolescence and then declining, and still others showing stability across development [3, 4•]. Understanding the risk and protective factors that may explain such variability is imperative for promoting optimal management in this population.

Late adolescence and emerging adulthood may be especially difficult because T1D management is a complex regulatory task that is challenged during this transitional time. To manage T1D effectively, individuals must regulate both themselves and their social relationships. Self-regulation involves the modulation of emotions, cognitions, and behaviors to achieve diabetes management goals. Social-regulation [5••] includes both how others may modulate one's emotions, cognitions, and behaviors to support diabetes management, as well as how individuals with T1D may actively regulate the

This article is part of the Topical Collection on *Psychosocial Aspects*

✉ Deborah J. Wiebe
dwiebe@ucmerced.edu

Cynthia A. Berg
cynthia.berg@psych.utah.edu

Daniel Mello
dmello2@ucmerced.edu

Caitlin S. Kelly
caitlin.kelly@psych.utah.edu

[1] Psychological Sciences and the Health Sciences Research Institute, University of California, Merced, 5200 N. Lake Road, Merced, CA 95343, USA

[2] Department of Psychology, University of Utah, 380 South 1530 East, Salt Lake City, UT 84112, USA

involvement of others. This may involve disclosing to others [6], seeking out helpful involvement, and preventing unhelpful involvement from others [7]. For example, effective adherence behaviors (e.g., testing blood glucose and adjusting insulin while out for dinner with friends) are more likely if individuals regulate not only their cognitions (remember to test) and emotions (minimize distress about managing diabetes) but also their social environment (solicit help from others to support their testing or keep others from interfering with testing). Individual differences in self-regulatory capacity (e.g., executive function, emotion regulation skills) are associated with diabetes management during late adolescence [8, 9•], and may affect both self- and social-regulation processes. However, these capacities are still developing in emerging adulthood, and the regulatory system is likely to be challenged as emerging adults face numerous life changes while experiencing declines in parental involvement [10, 11] and increasingly managing diabetes in the presence of peers.

Our framework posits that self- and social-regulation are differentiated (yet related) structures that are important for T1D management and that change in their relationship during late adolescence and emerging adulthood [5••, 12••]. We have examined an array of diabetes-related facets of self-regulation (e.g., cognitive self-regulation failures such as forgetting to test, self-efficacy, positive and negative affect) and social-regulation (e.g., disclosing diabetes information to parents, receiving parental help), both at the individual difference as well as the daily level. Findings demonstrate that self- and social-regulation for diabetes management are associated in late adolescence and in early emerging adulthood. However, when late adolescents begin to emerge into adulthood, aspects of social-regulation (i.e., mothers' daily assistance) no longer predict coordinated changes toward better self-regulation and diabetes management [5••, 13]. Such findings raise central questions of whether and how other aspects of social-regulation become connected to self-regulation to support diabetes management in emerging adulthood.

In the present report, we review key components of self- and social-regulation that may comprise risk and protective factors for T1D management during late adolescence and emerging adulthood. A comprehensive review is beyond our scope (for additional reviews, see [12••, 14, 15•]). Instead, we highlight two facets of self-regulation (i.e., cognitive and emotional self-regulation processes) and of social-regulation (i.e., social-regulation involving parents and peers) that have been the focus of active research and appear important for diabetes management. We review how these facets are associated with diabetes management during late adolescence and emerging adulthood, and explore links between self- and social-regulation at this time of development. Findings suggest that emerging adulthood is not a time when the goal is to be "independent" from others in diabetes management, but rather is a time when one needs to engage one's social relationships to be involved in and supportive of diabetes management.

Individual Risk and Protective Factors in the Self-Regulation of T1D

Cognitive Processes and Self-Regulation in T1D Management

Research on cognitive function as a resource for managing T1D is fairly new in pediatric and adolescent diabetes [8, 16–18]. Prior research examined whether those with T1D may have lower cognitive function than their healthy counterparts [19, 20]. Recently, however, researchers have examined how overall intellectual functioning [16] and self-report [21] and performance-based measures of executive function (EF) [9•, 22] may be associated with better adherence and glycemic control during late adolescence and emerging adulthood.

Problems with EF pose risks for poorer adherence and glycemic control during late adolescence and emerging adulthood. EF has most frequently been examined via the BRIEF [23], a widely used self-report measure that assesses a range of problems in EF (e.g., I do not plan ahead for future activities). More parent-reported EF problems during early adolescence [24, 25] and self-reported EF problems during late adolescence [9•] were associated concurrently with poorer adherence and/or glycemic control. Self-reported EF and diabetes management are also related longitudinally [21]. Increases in parent-reported behavioral regulation (i.e., subscale measuring ability to shift cognitive set and maintain emotional control) were related to slower deterioration in adherence across 2 years in early adolescence; scores on the metacognitive subscale were not associated with changes in adherence across time. The authors suggested that these different patterns may have occurred because parents see and engage more with the behavioral aspects of adherence than with the metacognitive processes (e.g., planning) that are involved in adherence [21]. In a follow-up report, fewer EF problems on the composite BRIEF scale identified a low-risk group that maintained good glycemic control across 3 years [26•]. Longitudinal research is needed across late adolescence and emerging adulthood, especially given findings that parent-report of EF problems were associated more strongly with poorer adherence and glycemic control during late versus early adolescence [27].

Multiple facets of cognition may relate to adherence and glycemic control during late adolescence and emerging adulthood. To assess these, we obtained self- and mother-report measures of multiple cognitive competencies (e.g., EF, sustained attention, sensitivity to rewards), as well as performance-based measures of intellectual function and EF from late adolescents during their senior year of high school.

Self- and maternal-reported problems in EF and attention were associated with poorer adherence and glycemic control [8]. Performance-based measures of EF were associated with better glycemic control, but not with adherence [9•]. Impairments in emotional decision-making abilities (i.e., Iowa Gambling Task) were especially predictive of deterioration in glycemic control across the year after high school [22].

Problems in EF may be detrimental because they are associated with daily failures in self-regulation and diabetes goal planning. After completing the BRIEF to measure EF problems, late adolescents completed a daily diary protocol for 14 days, reporting each day on level of effort and planning to achieve their most important diabetes goals, self-regulation failures related to blood glucose testing (e.g., being distracted or forgetting to test), adherence behaviors, and blood glucose levels. Greater problems in EF were associated subsequently with more daily self-regulation failures ($r = 0.31$) [8] and with less daily planning ($r = -0.27$) and effort expended toward diabetes goals ($r = -0.25$) [7]. In addition, greater daily self-regulation failures and lower daily goal planning were associated with lower daily adherence above and beyond the significant contribution of EF problems. Thus, even individuals with good EF showed self-regulation lapses in daily life that disrupted diabetes management, suggesting that interventions targeting daily self-regulation processes may be useful.

Daily self-regulation failures appear to be a key facet of cognition related to daily diabetes management. Multiple facets of daily self-regulation were examined in the daily diary. In both the senior year of high school [5••] and the year after high school [13], self-regulation failures were coordinated with numerous other facets of self-regulation (e.g., adherence behaviors, self-efficacy for diabetes management), such that changes in self-regulation failures co-occurred with changes in all other facets. Further, self-regulation failures served as a "driver" of these coordinated changes in self-regulation, suggesting that they sparked changes in other facets (e.g., reducing adherence behaviors, undermining self-efficacy beliefs). This dynamic systems work suggests that interventions targeting daily self-regulation failures may have broad effects on self-regulation to support diabetes management.

Emotional Processes and Self-Regulation in T1D Management

Emotional processes represent another important focus of self-regulation, with difficulties in emotion regulation posing significant risks for T1D management. Substantial literatures indicate that individuals with higher symptoms of depression or diabetes distress (i.e., emotional distress generated by the challenges of managing diabetes) experience poorer adherence and glycemic control during adolescence [28, 29], and poorer diabetes management, more microvascular complications, and heightened health care costs in adulthood [30, 31]. Presumably, emotion regulation processes underlie these heightened symptoms [32], raising questions of whether difficulties in emotion regulation pose a risk for late adolescents and emerging adults with T1D.

Such associations are particularly concerning for late adolescents and emerging adults because depressive symptoms in non-diabetes populations increase normatively across adolescence, reaching a peak at this time of development [33, 34]. Cross-sectional studies suggest that young adults with T1D experience higher levels of diabetes distress than either adolescents [35] or older adults [36]. However, longitudinal studies indicate that elevated symptoms of depression and diabetes distress are relatively stable across adolescence and emerging adulthood [37•, 38]. Such continuity in emotion regulation difficulties may explain why individuals with heightened diabetes distress [39] and depressive symptoms [4•, 39, 40] during early adolescence display riskier longitudinal trajectories of glycemic control into late adolescence and emerging adulthood.

Regardless of whether late adolescents and emerging adults show higher emotional distress compared to other ages, elevated emotional distress is prevalent and may undermine diabetes management [2]. Recent studies specifically examining late adolescents and emerging adults reveal that those with lower emotion regulation skills (by self- and mother-report) displayed poorer adherence and glycemic control [8]. Similarly, elevated depressive symptoms were associated concurrently with poorer adherence [41, 42•] and glycemic control [41, 43], and elevated diabetes distress was associated concurrently with poorer glycemic control [37•]. Although lack of associations with glycemic control have also been reported for both depressive symptoms [37•] and diabetes distress [35], cross-sectional studies generally support the risk of emotional distress for poorer diabetes management during emerging adulthood. Longitudinal studies are less clear. In a sample of 10–18-year olds, neither baseline levels nor changes in depressive symptoms predicted glycemic control across 5 years [38]. Similarly, in a sample of 18–30-year olds, neither depressive symptoms nor diabetes distress predicted glycemic control across 5 years [37•]. Future longitudinal research examining smaller age ranges and time spans may clarify the direction of associations between emotional distress and poor diabetes management during late adolescence and emerging adulthood.

Daily diary studies suggest a central role for emotion regulation when managing diabetes in daily life. First, individual differences in emotion regulation are associated with daily self-regulation surrounding diabetes. Late adolescents who reported having difficulty with emotion regulation (i.e., lower emotional awareness, acceptance, and regulation skills) reported more daily self-regulation failures [8], and those with higher depressive symptoms had more severe daily diabetes

problems, poorer daily adherence, and poorer daily blood glucose control on average across a 2-week period [41]. On days when diabetes problems were more severe, participants also reported poorer adherence. Second, the ability to regulate daily diabetes-related affect appears to be important for daily diabetes management. In younger adolescents, lower trait levels of self-regulation (i.e., lower self-control) were associated with higher daily diabetes-related negative affect, which in turn mediated links with higher daily blood glucose [44]. Furthermore, associations of heightened daily negative affect and lower positive affect with higher daily blood glucose were mediated through lower perceived competence in managing diabetes problems [45]. Taken together, findings suggest that late adolescents with difficulties in emotion regulation experience self-regulation failures in daily life, potentially generating more severe diabetes problems and elevating negative affect which undermine adherence and blood glucose control. Future research is needed to understand whether and how daily aspects of emotion regulation are linked to diabetes management during emerging adulthood. Such research will benefit from precisely measuring different aspects of emotion-regulation and linking these aspects to daily affect and diabetes self-management processes across time.

Self-Regulation Links to Social-Regulation

Research presented thus far demonstrates the importance of self-regulation for how late adolescents and emerging adults individually manage diabetes. However, self-regulation may also be a foundation for interpersonal processes involved in diabetes management [14]. For example, late adolescents with EF problems made fewer daily plans to keep others from interfering with diabetes goals, and such planning lapses were associated with poorer daily adherence [7]. Similarly, heightened depressive symptoms predicted subsequent problems in diabetes-related social support [37•]. In the next section, we discuss interpersonal processes that are important for the social-regulation of diabetes management during late adolescence and emerging adulthood.

Interpersonal Risk and Protective Factors in the Social-Regulation of T1D

Social-Regulation Involving Parents and T1D Management

Social-regulation in late adolescence and emerging adulthood frequently involves parents, who may have been heavily involved in diabetes management since diagnosis but whose role is changing at this time of development. Multiple aspects of parental involvement in diabetes typically decline across adolescence (i.e., parent-adolescent relationship quality, parental monitoring or knowledge about diabetes, parental responsibility for diabetes management tasks) [10, 11], as parents become less directly involved in their adolescent's life. Moreover, parents transition from direct involvement to being a backup system of "guiding agents" who are available for consultation when needed [15•, 46, 47].

Although parental involvement in T1D continues to decline across late adolescence and emerging adulthood [48, 49•], maintaining a high-quality relationship with parents provides a key foundation from which individuals can utilize their parents for support [50]. Warm and responsive relationships with parents were associated concurrently with better adherence and glycemic control, especially during early emerging adulthood [49•, 51], and those who perceived high parental support in the year after high school displayed better adherence across the transition after high school [52]. In contrast, negative relationships characterized by parental psychological control [51] or conflict were linked to poorer glycemic control during emerging adulthood [53]. Responsive and supportive relationships with parents may thus provide a resource for diabetes management that emerging adults can draw upon when needed.

Parental involvement may support diabetes management by facilitating self-regulation processes during late adolescence and emerging adulthood. In a sample of emerging adults, higher parental knowledge (i.e., reflecting higher parental monitoring and emerging adults' disclosures to parents) was not directly associated with better adherence, but was indirectly associated through lower psychological distress [42•]. Furthermore, supportive parental relationships were associated with lower depressive symptoms and risk behaviors (e.g., smoking) across the first year after high school [52], and parental responsiveness predicted lower diabetes distress across 1 year during early emerging adulthood [49•]. Such findings suggest that support from parents may facilitate the emotion regulation processes that are important for diabetes management during late adolescence and emerging adulthood. It is less clear how social-regulation involving parents is associated with cognitive aspects of self-regulation, given limited research. One study reported that relationship quality with parents during late adolescence was not associated with daily cognitive self-regulation failures related to blood glucose testing, although receipt of daily help from mothers was associated with fewer daily self-regulation failures [54].

Social-regulation involves not only how social resources may facilitate one's self-regulation (i.e., social resources modulate one's own emotions, cognitions, and behaviors) but also how individuals more directly regulate engagement with those social resources. Active regulation of parents' involvement may be especially important during late adolescence and emerging adulthood because parents have fewer opportunities to observe directly their child's need for support and guidance. Maintaining positive relationships and disclosing to parents about diabetes may be ways that parents come to know about

the need for help with diabetes-related problems. We found that late adolescents' diabetes-related disclosures to parents were associated with higher levels of parental knowledge about their diabetes management and higher parental help with diabetes [54]. Disclosure to parents may thus be a protective social-regulation factor that facilitates self-regulation and T1D management during late adolescence. Conversely, keeping secrets about diabetes from parents was inversely associated with late adolescents' relationship quality with parents, disclosure, and parental knowledge of diabetes, as well as poorer adherence and glycemic control [55]. Thus, secrecy may be a symptom of an unhealthy relationship with parents that involves the late adolescent's attempt at regulating their social environment to reduce negative interactions with parents, but at the risk of undermining diabetes management.

Social-Regulation Involving Friends and Romantic Partners and T1D Management

Social-regulation increasingly involves peer relationships (e.g., friends, romantic partners) during adolescence and emerging adulthood. Adolescents view friends as sources of both support and conflict, and perceive supportive friends as beneficial to diabetes management [56]. However, it is unclear whether friend involvement is helpful or harmful for diabetes management. A review of research on adolescents concluded that friend or peer conflict may be more detrimental than support is helpful for diabetes management [57].

Although research is limited, friends continue to help and hinder T1D management during late adolescence and emerging adulthood, with some research supporting the idea that friend's support occurs through self-regulation processes. Perceptions of higher general support from friends (e.g., non-diabetes instrumental and emotional support) during the senior year of high school predicted lower distress, while perceptions of friend conflict predicted higher distress and risk behaviors over the subsequent year; neither friend support nor conflict predicted adherence or glycemic control [52]. In a sample of both adolescents and emerging adults, general friend support again predicted lower distress but not diabetes management across the subsequent year [49•]. Interestingly, emerging adults who were highly "peer oriented" (i.e., willing to forego diabetes management to connect with friends) showed deterioration in glycemic control across 1 year, an effect that was not present among adolescents [49•]. Difficulties in social-regulation involving friends may thus pose risks for poor diabetes management especially during emerging adulthood.

Although general friend support was not related to diabetes outcomes, diabetes-specific support may be helpful. We recently found that diabetes-specific friend support (i.e., friends are knowledgeable about T1D status and emergency treatment, and provide support for diabetes) in the senior year of high school predicted better adherence across the subsequent year (unpublished data). The benefits of friend involvement in diabetes may also depend on the need for assistance. In the year after high school, diabetes-specific friend support was associated with adherence only when early emerging adults perceived themselves as less proficient in managing diabetes independently [58]. Thus, regulating friend support for diabetes may be most important when emerging adults are struggling to assume adult-like management tasks.

Research on the role of romantic partners in the social-regulation of diabetes management is lacking in this age group. Late adolescents and emerging adults with diabetes appear less likely to have a romantic partner, and may place less value on some aspects of romantic relationships (i.e., intimacy) than those without diabetes [59, 60]. Similar to findings with friends, general support from romantic partners was concurrently associated with lower distress during early emerging adulthood, while partner conflict was associated with heightened distress and poorer adherence [60]. Although this suggests that regulating positive relationships with romantic partners may be important to support diabetes management during emerging adulthood, the paucity of research limits conclusions. Given the importance of romantic partners in self-regulating diabetes management in older adults [50, 61], understanding how emerging adults regulate their romantic partners' involvement to facilitate diabetes management is a crucial area for future research, especially given the instability of romantic relationships across this developmental period.

Conclusions and Recommendations

The framework of self- and social-regulation for organizing risk and protective factors involved in T1D management during late adolescence and emerging adulthood holds important implications for future research. This framework emphasizes that adolescents and emerging adults manage T1D in a social context that can both facilitate and derail self-regulation oriented toward diabetes management. Rather than suggesting the importance of "independence" in diabetes management at this time of development, research reveals that late adolescents and emerging adults benefit from actively regulating the involvement of others. Research is suggestive of important connections between self- and social-regulation, such as evidence that those with stronger EF skills may be better able to regulate their social context so that others do not interfere with diabetes management [7]. Research in social psychology indicates that individuals who are more effective at self-regulation strategically spend time and collaborate with others who have strong self-regulation skills [62]. Additional research is needed to explore the connections between self- and social-regulation. Such research is important because it

may expand the impact of interventions targeting self-regulation skills to interpersonal outcomes, and open up new interventions targeting the social context to support diabetes management at this high-risk time.

Parents continue to play a crucial role in T1D management during late adolescence and emerging adulthood, but more research is needed to understand how emerging adults actively regulate the involvement of parents as well as other social relationships. In particular, understanding how romantic partners become a part of the regulatory system during emerging adulthood is crucial, given evidence that romantic partners are a central resource for diabetes self-management during adulthood [50, 61]. Research is needed to understand the role of diabetes-specific support from friends, as parental involvement wanes but before romantic partners become linked to the regulatory system. Research may also benefit from examining self- and social-regulation in the context of health care providers, especially given findings that communication with health care providers begins to increase as collaboration with parents declines in the year after high school [48]. As this research evolves, it may be that social-regulation elicited from and provided by certain relationships (e.g., parents versus friends versus health care providers) facilitates specific aspects of self-regulation. For instance, we found that higher daily parental support in late adolescence was linked to reduced daily cognitive self-regulation failures [54]. Relationships with people that may be less involved in daily aspects of diabetes management (e.g., friends, health care providers) may not be linked to such daily aspects of self-regulation, but may facilitate broader aspects of self-regulation related to diabetes management.

The framework of self- and social-regulation advanced here also has implications for clinical practice and interventions. Individuals who are at risk for poor diabetes management (e.g., lower cognitive and emotional self-regulation skills) could be targeted for tailored interventions. Those with lower cognitive function who experience daily self-regulatory failures may benefit from structured reminders (e.g., text messages) to complete tasks, or from strategies to enhance planning and organization [18]. Those with difficulties in emotion regulation may benefit from psychoeducation interventions to address elevated diabetes distress or mental health consultations for more long-standing depressive symptoms [63, 64]; interventions to regulate daily affect may also be helpful [65]. In addition, for individuals experiencing risks in facets of self-regulation, enhancing social-regulation may provide the compensation needed to facilitate optimal diabetes management. Assessment of helpful and unhelpful social resources and training in how to manage relationships to support diabetes may be useful. Such interventions could involve developing coping or problem-solving skills to deal with social situations that may derail diabetes management [66, 67], or more direct coaching to identify and address actions that support or interfere with diabetes management [68] Different interventions may also be needed at different developmental time points. For instance, during late adolescence, the focus may involve facilitating autonomy supportive help from parents, whereas interventions during emerging adulthood may need to focus on how to engage friends and romantic partners for support. Although late adolescence and emerging adulthood remains an understudied time, the accumulating evidence supports that facets of self- and social-regulation are important risk and protective factors that may guide future interventions to promote more effective diabetes management.

Acknowledgements Deborah J. Wiebe and Cynthia A. Berg received grant support from the National Institute of Diabetes and Digestive and Kidney Diseases.

Compliance with Ethical Standards

Conflict of Interest Deborah J. Wiebe, Cynthia A. Berg, Daniel Mello, and Caitlin S. Kelly declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent All reported studies with human subjects performed by the authors have been previously published and complied with all applicable ethical standards (including the Helsinki declaration and its amendments, institutional/national research committee standards, and international/national/institutional guidelines). Informed consent was obtained from all individual participants included in these studies.

References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

1. Arnett JJ. Conceptions of the transition to adulthood: perspectives from adolescence through midlife. J Adult Dev. 2001;8(2):133–43. https://doi.org/10.1023/A:1026450103225.
2. Peters A, Laffel L. Diabetes care for emerging adults: recommendations for transition from pediatric to adult diabetes care systems. Diabetes Care. 2011;34:2477–85. https://doi.org/10.2337/dc11-1723.
3. Schwandt A, Hermann JM, Rosenbauer J, Boettcher C, Dunstheimer D, Grulich-Henn J, et al. Longitudinal trajectories of metabolic control from childhood to young adulthood in type 1 diabetes from a large German/Austrian registry: a group-based modeling approach. Diabetes Care. 2017;40(3):309–16. https://doi.org/10.2337/dc16-1625.
4.• Helgeson VS, Vaughn AK, Seltman H, Orchard T, Libman I, Becker D. Trajectories of glycemic control over adolescence and emerging adulthood: an 11-year longitudinal study of youth with type 1 diabetes. J Pediatr Psychol. 2017:1–11. https://doi.org/10.1093/jpepsy/jsx083. **Article showing that facets of self- and social-regulation during early adolescence predict individual differences in longitudinal trajectories of glycemic control across adolescence and into emerging adulthood.**

5.•• Butner JE, Berg CA, Munion AK, Turner SL, Hughes-Lansing A, Winnick JB, et al. Coordination of self- and parental-regulation surrounding type 1 diabetes management in late adolescence. Ann Behav Med. 2017:1–13. https://doi.org/10.1007/s12160-017-9922-0. **Article that models a dynamic systems approach to daily self- and social-regulation for type 1 diabetes management during late adolescence.**

6. Berg CA, Butner JE, Turner SL, Lansing AH, King P, Wiebe DJ. Adolescents', mothers', and fathers' reports of adherence across adolescence and their relation to HbA1c and daily blood glucose. J Behav Med. 2016;39(6):1009–19. https://doi.org/10.1007/s10865-016-9771-5.

7. Wiebe DJ, Berg CA, Baker A, Stump T. Managing type 1 diabetes in late adolescence: individual and daily fluctuations in goal regulation. Health Psychol. 2018. https://doi.org/10.1037/hea0000624.

8. Berg CA, Wiebe DJ, Suchy Y, Hughes AE, Anderson JH, Godbey EI, et al. Individual differences and day-to-day fluctuations in perceived self-regulation associated with daily adherence in late adolescents with type 1 diabetes. J Pediatr Psychol. 2014;39(9):1038–48. https://doi.org/10.1093/jpepsy/jsu051.

9.• Suchy Y, Turner SL, Queen TL, Durracio K, Wiebe DJ, Butner J, et al. The relation of questionnaire and performance-based measures of executive functioning with type 1 diabetes outcomes among late adolescents. Health Psychol. 2016;35(7):661–9. https://doi.org/10.1037/hea0000326. **Article demonstrating that both self-report and performance measures of executive functioning are related to diabetes management in late adolescence.**

10. King PS, Berg CA, Butner JE, Butler JM, Wiebe DJ. Longitudinal trajectories of parental involvement in type 1 diabetes and adolescents' adherence. Health Psychol. 2014;33(5):424–32. https://doi.org/10.1037/a0032804.

11. Wiebe DJ, Chow CM, Palmer DL, Butner JE, Butler JM, Osborn P, et al. Developmental processes associated with longitudinal declines in parental responsibility and adherence to type 1 diabetes management across adolescence. J Pediatr Psychol. 2014;39(5):532–41. https://doi.org/10.1093/jpepsy/jsu006.

12.•• Berg CA, Butner JE, Wiebe DJ, Lansing AH, Osborn P, King PS, et al. Developmental model of parent-child coordination for self-regulation across childhood and into emerging adulthood: type 1 diabetes management as an example. Dev Rev. 2017;46:1–26. https://doi.org/10.1016/j.dr.2017.09.001. **Comprehensive review linking social-regulation involving parents during childhood and adolescence, and involving peers and health care providers during late adolescence and emerging adulthood to diabetes management.**

13. Munion AK, Butner JE, Wiebe DJ, Berg CA. Self- and social-regulation in emerging adults with type 1 diabetes. Ann Behav Med. 2017;51(Suppl 1):S1072–2867. https://doi.org/10.1007/s12160-017-9903-3.

14. Lansing AH, Berg CA. Topical review: adolescent self-regulation as a foundation for chronic illness self-management. J Pediatr Psychol. 2014;39(10):1091–6. https://doi.org/10.1093/jpepsy/jsu067.

15.• Monaghan M, Helgeson V, Wiebe DJ. Type 1 diabetes in young adulthood. Curr Diabetes Rev. 2015;11(4):239–50. https://doi.org/10.2174/1573399811666150421114957. **Thorough review of the biopsychosocial challenges facing emerging adults with type 1 diabetes.**

16. Berg CA, Hughes AE, King PS, Korbel C, Fortenberry KT, Donaldson D, et al. Self-control as a mediator of the link between intelligence and hba1c during adolescence. Child Heal Care. 2014;43(2):120–31. https://doi.org/10.1080/02739615.2013.837819.

17. Duke DC, Harris MA. Executive function, adherence, and glycemic control in adolescents with type 1 diabetes: a literature review. Curr Diab Rep. 2014;14(10):532–42. https://doi.org/10.1007/s11892-014-0532-y.

18. Wasserman RM, Hilliard ME, Schwartz D, Anderson BJ. Practical strategies to enhance executive functioning and strengthen diabetes management across the lifespan. Curr Diab Rep. 2015;15(8):37–54. https://doi.org/10.1016/bs.mcb.2015.01.016.

19. Broadley MM, White MJ, Andrew B. A systematic review and meta-analysis of executive function performance in type 1 diabetes mellitus. Psychosom Med. 2017;79:684–96. https://doi.org/10.1097/PSY.0000000000000460.

20. Ryan CM, van Duinkerken E, Rosano C, van Duinkerken E, Rosano C. Neurocognitive consequences of diabetes. Am Psychol. 2016;71(7):563–76. https://doi.org/10.1037/a0040455.

21. Miller MM, Rohan JM, Delamater A, Shroff-Pendley J, Dolan LM, Reeves G, et al. Changes in executive functioning and self-management in adolescents with type 1 diabetes: a growth curve analysis. J Pediatr Psychol. 2012;38(1):18–29. https://doi.org/10.1093/jpepsy/jss100.

22. Suchy Y, Queen TL, Huntbach B, Wiebe DJ, Turner SL, Butner J, et al. Iowa gambling task performance prospectively predicts changes in glycemic control among adolescents with type 1 diabetes. J Int Neuropsychol Soc. 2017;23(3):204–13. https://doi.org/10.1017/S135561771600103X.

23. Gioia GA, Isquith PK, Retzlaff PD, Espy KA. Confirmatory factor analysis of the behavior rating inventory of executive function (BRIEF) in a clinical sample. Child Neuropsychol. 2002;8(4):249–57. https://doi.org/10.1076/chin.8.4.249.13513.

24. McNally K, Rohan J, Pendley JS, Delamater A, Drotar D. Executive functioning, treatment adherence, and glycemic control in children with type 1 diabetes. Diabetes Care. 2010;33(6):1159–62. https://doi.org/10.2337/dc09-2116.

25. Perez KM, Patel NJ, Lord JH, Savin KL, Monzon AD, Whittemore R, et al. Executive function in adolescents with type 1 diabetes: relationship to adherence, glycemic control, and psychosocial outcomes. J Pediatr Psychol. 2017;42(6):636–46. https://doi.org/10.1093/jpepsy/jsw093.

26.• Rohan JM, Rausch JR, Pendley JS, Delamater AM, Dolan L, Reeves G, et al. Identification and prediction of group-based glycemic control trajectories during the transition to adolescence. Health Psychol. 2014;33(10):1143–52. https://doi.org/10.1037/hea0000025. **Article showing that self-report of problems in executive function predict poor trajectories of glycemic control across three years during adolescence.**

27. Goethals ER, de Wit M, Van Broeck N, Lemiere J, Van Liefferinge D, Böhler S, et al. Child and parental executive functioning in type 1 diabetes: their unique and interactive role toward treatment adherence and glycemic control. Pediatr Diabetes. 2017:1–7. https://doi.org/10.1111/pedi.12552.

28. Hagger V, Hendrieckx C, Sturt J, Skinner TC, Speight J. Diabetes distress among adolescents with type 1 diabetes: a systematic review. Curr Diab Rep. 2016;16(1):9. https://doi.org/10.1007/s11892-015-0694-2.

29. Johnson B, Eiser C, Young V, Brierley S, Heller S. Prevalence of depression among young people with type 1 diabetes: a systematic review. Diabet Med. 2013;30(2):199–208. https://doi.org/10.1111/j.1464-5491.2012.03721.x.

30. de Groot M, Golden SH, Wagner J. Psychological conditions in adults with diabetes. Am Psychol. 2016;71(7):552–62. https://doi.org/10.1037/a0040408.

31. Sturt J, Dennick K, Due-Christensen M, McCarthy K. The detection and management of diabetes distress in people with type 1 diabetes. Curr Diab Rep. 2015;15(101):1–14. https://doi.org/10.1007/s11892-015-0660-z.

32. Compas BE, Jaser SS, Bettis AH, Watson KH, Gruhn MA, Dunbar JP, et al. Coping, emotion regulation, and psychopathology in childhood and adolescence: a meta-analysis and narrative review. Psychol Bull. 2017;143(9):939–91. https://doi.org/10.1037/bul0000110.

33. Galambos NL, Barker ET, Krahn HJ. Depression, self-esteem, and anger in emerging adulthood: seven-year trajectories. Dev Psychol. 2006;42(2):350–65. https://doi.org/10.1037/0012-1649.42.2.350.
34. Kessler RC, Mickelson KD, Walters EE, Zhao S, Hamilton L. Age and depression in the MIDUS survey. In: Brim OG, Ryff CD, Kessler RC, editors. How heal. Are we? A Natl. Study well-being midlife. Chicago: University of Chicago Press. p. 227–51.
35. Lašaitė L, Dobrovolskienė R, Danytė E, Stankutė I, Ražanskaitė-Virbickienė D, Schwitzgebel V, et al. Diabetes distress in males and females with type 1 diabetes in adolescence and emerging adulthood. J Diabetes Complicat. 2016;30(8):1500–5. https://doi.org/10.1016/j.jdiacomp.2016.08.013.
36. Fisher L, Polonsky WH, Hessler DM, Masharani U, Blumer I, Peters AL, et al. Understanding the sources of diabetes distress in adults with type 1 diabetes. J Diabetes Complicat. 2015;29(4):572–7. https://doi.org/10.1016/j.jdiacomp.2015.01.012.
37.• Rassart J, Luyckx K, Bijttebier P, Berg CA, Moons P, Weets I. Psychosocial functioning and glycemic control in emerging adults with type 1 diabetes: a 5-year follow-up study. Health Psychol. 2015;34(11):1058–65. https://doi.org/10.1037/hea0000212. **Longitudinal study showing associations of diabetes distress and depressive symptoms with diabetes management across time during emerging adulthood.**
38. Hood KK, Beavers DP, Yi-Frazier J, Bell R, Dabelea D, Mckeown RE, et al. Psychosocial burden and glycemic control during the first six years of diabetes: results from the SEARCH for diabetes in youth study. J Adolesc Health. 2014;55(4):498–504. https://doi.org/10.1016/j.jadohealth.2014.03.011.
39. Hilliard ME, Wu YP, Rausch J, Dolan LM, Hood KK. Predictors of deteriorations in diabetes management and control in adolescents with type 1 diabetes. J Adolesc Health. 2013;52(1):28–34. https://doi.org/10.1016/j.jadohealth.2012.05.009.
40. King PS, Berg CA, Butner JE, Drew LM, Foster C, Donaldson D, et al. Longitudinal trajectories of metabolic control across adolescence: associations with parental involvement, adolescents' psychosocial maturity, and health care utilization. J Adolesc Health. 2012;50(5):491–6. https://doi.org/10.1016/j.jadohealth.2011.09.007.Longitudinal.
41. Baucom KJW, Queen TL, Wiebe DJ, Turner SL, Fortenberry KT, Anderson JH, et al. Depressive symptoms, daily stress, and adherence in adolescents with type 1 diabetes. Health Psychol. 2015;34:522–30. https://doi.org/10.1037/hea0000219.
42.• Helgeson VS, Vaughn AK, Seltman H, Orchard T, Becker D, Libman I. Relation of parent knowledge to glycemic control among emerging adults with type 1 diabetes: a mediational model. J Behav Med. 2017:1–9. https://doi.org/10.1007/s10865-017-9886-3. **Article demonstrating the importance of parental involvement in emotion regulation and diabetes management during emerging adulthood.**
43. Bachle C, Lange K, Stahl-Pehe A, Castillo K, Holl RW, Giani G, et al. Associations between HbA1c and depressive symptoms in young adults with early-onset type 1 diabetes. Psychoneuroendocrinology. 2015;55:48–58. https://doi.org/10.1016/j.psyneuen.2015.01.026.
44. Hughes-Lansing A, Berg CA, Butner JE, Wiebe DJ. Self-control, daily negative affect and blood glucose control in adolescents with type 1 diabetes. Health Psychol. 2016;35(7):643–61. https://doi.org/10.1037/hea0000325.
45. Fortenberry KT, Butler JM, Butner JE, Berg CA, Upchurch R, Wiebe DJ. Perceived diabetes task competence mediates the relationship of both negative and positive affect with blood glucose in adolescents with type 1 diabetes. Ann Behav Med. 2009;37(1):1–9. https://doi.org/10.1007/s12160-009-9086-7.
46. Hilliard ME, Perlus JG, Clark LM, Haynie DL, Plotnick LP, Guttmann-Bauman I, et al. Perspectives from before and after the pediatric to adult care transition: a mixed-methods study in type 1 diabetes. Diabetes Care. 2014;37(2):346–54. https://doi.org/10.2337/dc13-1346.
47. Sparud-Lundin C, Öhrn I, Danielson E. Redefining relationships and identity in young adults with type 1 diabetes. J Adv Nurs. 2010;66(1):128–38. https://doi.org/10.1111/j.1365-2648.2009.05166.x.
48. Majumder E, Cogen FR, Monaghan M. Self-management strategies in emerging adults with type 1 diabetes. J Pediatr Health Care. 2016;31(1):29–36. https://doi.org/10.1016/j.pedhc.2016.01.003.
49.• Raymaekers K, Oris L, Prikken S, Moons P, Goossens E, Weets I, et al. The role of peers for diabetes management in adolescents and emerging adults with type 1 diabetes: a longitudinal study. Diabetes Care. 2017;40:1678–84. https://doi.org/10.2337/dc17-0643. **Longitudinal study showing helpful and unhelpful aspects of relationships with friends are associated with diabetes distress and diabetes management during adolescence and emerging adulthood.**
50. Wiebe DJ, Helgeson VS, Berg CA. The social context of managing diabetes across the life span. Am Psychol. 2016;71(7):526–38. https://doi.org/10.1037/a0040355.
51. Goethals ER, Oris L, Soenens B, Berg CA, Prikken S, Van Broeck N, et al. Parenting and treatment adherence in type 1 diabetes throughout adolescence and emerging adulthood. J Pediatr Psychol. 2017;42:1–11. https://doi.org/10.1093/jpepsy/jsx053.
52. Helgeson VS, Palladino DK, Reynolds KA, Becker DJ, Escobar O, Siminerio L. Relationships and health among emerging adults with and without type 1 diabetes. Health Psychol 2014;33:1125–1133. https://doi.org/10.1002/aur.1474.Replication.
53. Hanna KM, Weaver MT, Stump TE, Guthrie D, Oruche UM. Emerging adults with type 1 diabetes during the first year post-high school: perceptions of parental behaviors. Emerg Adulthood. 2014;2(2):128–37. https://doi.org/10.1177/2167696813512621.
54. Berg CA, Queen TL, Butner JE, Turner SL, Lansing AH, Main A, et al. Adolescent disclosure to parents and daily management of type 1 diabetes. J Pediatr Psychol. 2017;42(1):75–84. https://doi.org/10.1093/jpepsy/jsw056.
55. Main A, Wiebe DJ, Van Bogart K, Turner SL, Tucker C, Butner JE, et al. Secrecy from parents and type 1 diabetes management in late adolescence. J Pediatr Psychol. 2015;40(10):1075–84. https://doi.org/10.1093/jpepsy/jsv060.
56. Peters LWH, Nawijn L, van Kesteren NMC. How adolescents with diabetes experience social support from friends: two qualitative studies. Scientifica. 2014. p 8. https://doi.org/10.1155/2014/415849.
57. Palladino DK, Helgeson VS. Friends or foes? A review of peer influence on self-care and glycemic control in adolescents with type 1 diabetes. J Pediatr Psychol. 2012;37(5):591–603. https://doi.org/10.1093/jpepsy/jss009.
58. Kelly CS, Berg CA, Ramsey MA, Baker AC, Donaldson DL, Swinyard MT, et al. Relationships and the development of transition readiness skills into early emerging adulthood for individuals with type 1 diabetes. Child Heal Care. 2017:1–18. https://doi.org/10.1080/02739615.2017.1354294.
59. Seiffge-Krenke I. Diversity in romantic relations of adolescents with varying health status: Links to intimacy in close relationships. J Adolesc Res. 2000;15(6):611–36. https://doi.org/10.1177/0743558400156001.
60. Helgeson VS, Mascatelli K, K a R, Becker D, Escobar O, Siminerio L. Friendship and romantic relationships among emerging adults with and without type 1 diabetes. J Pediatr Psychol. 2015;40:359–72.
61. Trief PM, Sandberg JG, Dimmock JA, Forken PJ, Weinstock RS. Personal and relationship challenges of adults with type 1 diabetes. Diabetes Care. 2013;36(9):2483–8. https://doi.org/10.2337/dc12-1718.
62. vanDellen MR, Shah JY, Leander NP, Delose JE, Bornstein JX. In good company: managing interpersonal resources that support self-

regulation. Personal Soc Psychol Bull. 2015;41(6):870–82. https://doi.org/10.1177/0146167215580778.

63. Sturt J, Dennick K, Hessler D, Hunter BM, Oliver J, Fisher L. Effective interventions for reducing diabetes distress: systematic review and meta-analysis. Int Diabetes Nurs. 2015;12(2):40–55. https://doi.org/10.1179/2057332415Y.0000000004.
64. Young-Hyman D, De Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: a position statement of the American diabetes association. Diabetes Care. 2016;39(12):2126–40. https://doi.org/10.2337/dc16-2053.
65. Jaser SS, Patel N, Rothman RL, Choi L, Whittemore R. Check it!: a randomized pilot of a positive psychology intervention to improve adherence in adolescents with type 1 diabetes. Diabetes Educ. 2014;40(5):659–67. https://doi.org/10.1177/0145721714535990.
66. Grey M, Boland EA, Davidson M, Li J, Tamborlane WV. Coping skills training for youth with diabetes mellitus has long-lasting effects on metabolic control and quality of life. J Pediatr. 2000;137(1):107–13. https://doi.org/10.1067/mpd.2000.106568.
67. Mulvaney SA, Rothman RL, Wallston KA, Lybarger C, Dietrich MS. An internet-based program to improve self-management in adolescents with type 1 diabetes. Diabetes Care. 2010;33(3):602 LP–604. https://doi.org/10.2337/dc09-1881.
68. Mayberry LS, Berg CA, Harper KJ, Osborn CY. The design, usability, and feasibility of a family-focused diabetes self-care support mHealth intervention for diverse, low-income adults with type 2 diabetes. J Diabetes Res. 2016;2016(13):1–13. https://doi.org/10.1155/2016/7586385.