

Friends or Foes? A Review of Peer Influence on Self-Care and Glycemic Control in Adolescents With Type 1 Diabetes

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Objective We reviewed studies published from 1990 to 2010 examining the relation of peer influence to diabetes outcomes for adolescents with type 1 diabetes. **Methods** We searched PsychInfo and MedLine databases and personal archives for studies meeting our criteria. 24 articles were included in the final review. **Results** Qualitative studies revealed that teens believe peers have an impact on diabetes behaviors, but quantitative findings are inconclusive. We found more evidence that social conflict was harmful than social support was helpful. Associations were more likely in studies that measured specific support and specific self-care variables. Studies addressing how individual differences interact with social context had promising findings. **Conclusions** The literature linking peer relations to diabetes outcomes is mixed. Future research should consider moderator variables, expand the conceptualization of peer relationships, and consider interactions between person and social context.

Key words adherence; adolescent; friends; glycemic control; peers; self-care; type 1 diabetes.

Among the naturally occurring transitions during adolescence, social changes are some of the most salient. During these years, the social focus of teens moves from an adult-centered view to one that is peer-centered (Fulgini, Barber, Eccles, & Clements, 2001; Larson & Verma, 1999). Adolescents become more involved in extracurricular activities that keep them away from parental supervision and support on an increasing basis (Scholte, van Lieshout, & van Aken, 2001). These changes typically begin during the middle school years, when self-esteem has been found to decline (Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991). In fact, peer relationships have been found to be an important factor in determining social competence during childhood and adolescence (Ladd, 2008; Meece & Laird, 2006), and a sense of belonging has been linked to lower levels of depression, less social rejection, and fewer problems in school (Anderman, 2002). It is clear that peer relationships become a prominent factor in the well-being of teens. Peer relationships may play a particularly salient role in the life of an

adolescent with a chronic disease, especially one with a complicated daily regimen such as diabetes.

Individuals coping with type 1 diabetes (T1D) must manage a complex regimen of blood glucose testing, insulin administration, diet management, and exercise in order to maintain optimal blood glucose levels. Execution of these behaviors is important because failure to successfully manage them can lead to serious short term and long term consequences for teens' health (Hood, Peterson, Rohan, & Drotar, 2009). Research has shown that glycemic control in teens with T1D decreases during adolescence (Greening, Stoppelbein, Konishi, Jordan, & Moll, 2007). This decline has been attributed to physiology (Goran & Gower, 2001) as well as declines in self-care behavior (La Greca, Follansbee, & Skyler, 1990; La Greca, Swales, Klemp, Madigan, & Skyler, 1995). The transition from strong parental involvement to a more peer-focused lifestyle may present challenges to self-care behaviors (Holmes et al., 2006). Peer relationships can be particularly important when an adolescent's chronic disease involves self-care

behaviors throughout the day at school or during social events in the presence of others, as with T1D.

Peer relationships may influence diabetes outcomes in a number of ways. The literature shows that social support can be beneficial for health due to its provision of useful information and resources, decreased negative affect and increased self-esteem, and social control (Cohen, 1988). The main effects model emphasizes that these provisions of social support are beneficial for health in general, whereas the stress-buffering model predicts that social support is most beneficial for health under times of stress (Cohen & Wills, 1985). There is also literature suggesting that social relationships may have adverse effects on well-being, including social constraints (Lepore & Helgeson, 1998), social conflict (Rook, Sorkin, & Zettel, 2004), and support attempts that fail (Dakof & Taylor, 1990). In the case of adolescents with T1D, the relation of social support and social conflict from families to diabetes outcomes has been studied extensively (e.g., Berg et al., 2011; Helgeson, Reynolds, Siminerio, Escobar, & Becker, 2008; Ingerski, Anderson, Dolan, & Hood, 2010; Lewandowski & Drotar, 2007). Despite the potential for peers to influence the health of adolescents with diabetes, relatively little research has studied the effect of peer relationships on self-care behaviors and glycemic control.

This systematic review synthesizes findings in research published from 1990 to 2010 that examined the influence of peers on T1D self-care and glycemic control. This article will address: (a) the behaviors peers exhibit that help or hinder self-care and glycemic control and (b) how these behaviors relate to self-care and glycemic control.

We made several distinctions within peer relationships. First, we distinguished between positive and negative peer influences. We refer to the positive relationships as supportive relationships, and the negative relationships as social conflict. Within *supportive relationships* and *conflictual relationships*, we distinguish between general and diabetes specific. *General support* refers to the instrumental, emotional, or informational resources that others provide that are not targeted at diabetes self-care. *Diabetes-specific support* refers to the support from others that is targeted at self-care, such as assisting with blood glucose monitoring. *Social conflict* includes interactions with peers that are negative, conflictual, or problematic in some way. An example of *general conflict* is “showing off or bragging about being better at something,” and an example of *diabetes-specific conflict* is “offering food that one is unable to eat.”

Finally, some studies did not measure support or conflict, but examined other ways in which peers influence diabetes self-care, such as anticipated peer reactions to diabetes self-care. We refer to these as *other peer influences*.

This review considers articles that evaluate support and conflict, both general and diabetes specific, as well as other peer influences.

Method

Literature Search

We reviewed findings from studies published in English in peer-reviewed journals from 1990 through 2010 that explore the associations of peer relationships to diabetes self-care and glycemic control. We chose 1990 as the starting date to allow for inclusion of as many papers as possible, while also eliminating articles published during a time when diabetes care differed substantially from what it is today due to the tightened self-care recommendations from the Diabetes Control and Complications Trial (DCCT, 1993). In order for an article to be included in this review, the majority of the sample had to include youth with T1D, youth being defined as 18 years old or younger. We reviewed both qualitative studies that described the ways peers affect self-care and quantitative studies that linked peer relationships to self-care and glycemic control.

Exhaustive searches were conducted using both PsychInfo and Medline databases. Search terms included at least one term from each of the following: (a) friend* or peer*; (b) self*care, adherence, compliance, *A1c, or glycemic control; (c) adolescent*, child*, or teen*; and (d) diabetes, diabetic, or IDDM. After reading the abstracts of the 175 articles returned by PsychInfo and 185 articles returned by Medline for relevance and duplication, 53 and 55 were reviewed in detail, respectively. We also retrieved 18 articles from reviewing personal archives and reference lists of recently published review papers. Of the 126 articles reviewed, 24 met the inclusion criteria. Articles most often were excluded because they did not include measures of self-care behaviors or glycemic control (i.e., HbA1c) or the majority of participants were over 18 years old. The final 24 papers are indicated with an ‘asterisk’ in the reference section.

Results

The first section summarizes qualitative studies that address how adolescents believe peers impact their self-care. The next section reviews the quantitative studies that examine links of supportive peer relationships, social conflict, and other peer influences to self-care and glycemic control. Within the support and conflict sections, studies on general versus diabetes-specific support are distinguished. Finally, within each of those sections,

we distinguish between findings on self-care and glycemic control. Unless otherwise noted, all studies are cross-sectional and used a measure of general self-care behavior rather than a measure of individual domains of self-care (e.g., diet). Samples were largely white and studies did not adjust for any covariates in analyses, unless otherwise noted. Nearly half (45%) of the quantitative studies failed to provide any information about socioeconomic status (SES), and the remaining studies used heterogeneous measures, making comparisons based upon SES prohibitive.

The heterogeneity of independent variable measures and the relatively small number of studies reviewed

prohibited us from conducting a meta-analysis. However, whenever possible, we provide effect sizes so that comparisons can be made across studies (Table I).

Findings: What Do Peers Do?

The first step to determining what adolescents think is helpful or harmful to diabetes self-management is to ask them. Seven studies provided evidence that teens felt that peers had an influence on their self-care behaviors. Of these, four studies asked teens what they thought would influence self-care, and found that peer influence was a common component (Berlin, 2006; Karlsson, Arman, & Wikblad, 2008; Kyngas, Hentinen, & Barlow, 1998;

Table I. Characteristics and Findings of Studies Linking Peer Relations to Self-Care and Glycemic Control

Authors (year)	N (%F)	Age (years)	XS	Long	Ethnicity (%Caucasian)	Supportive Relationships		Social Conflict		Other Peer Infl
						General	Diabetes-specific	General	Diabetes-specific	
Self-care										
Skinner & Hampson (1998) [†]	74 (43)	12–18	X		99	✓(.47)/0	✓(.68)/0			
Skinner & Hampson (2000) [†]	52 (46)	12–18		X	100	✓(.85/.90)/0	0/0			
Helgeson et al. (2007)	132 (53)	10–14	X	X	91	0		0		
Helgeson, Lopez et al. (2009)	76 (50)	13–16	X	X	90	✓ ^{a,d} /0		✓ ^a /0		
Hains et al. (2007)	102 (60)	10–18	X		81		0			✓(1.22)
La Greca et al. (1995)	74 (39)	11–18	X		84		0			
Naar-King et al. (2006)	96 (54)	10–17	X		24		0			
Pendley et al. (2002)	68 (62)	8–17	X		88		0			
Greco et al. (2001)	21 (48)	10–18		X	81		0			
Bearman & La Greca (2002)	74 (40)	11–18	X		83		✓ ^a /0			
Kyngäs & Rissanen (2001)	1061 (50)	13–17	X		NR		✓(.41)			
Kyngäs et al. (1998)	51 (45)	13–17	X		NR		✓ ^c /0			
Thomas et al. (1997)	67 (49)	8–17	X		79					✓(1.30)
Drew et al. (2010)	252 (54)	10–15		X	94					✓(–.58)
Grey et al. (1998)	65 (57)	13–20		X	92					0
Glycemic control										
Kager & Holden (1992)	64 (67)	7–15	X		94	0				
Helgeson et al. (2007) [‡]	132 (53)	10–14	X	X	91	0		✓ ^b ✓ ^a		
Helgeson, Siminerio et al. (2009) [‡]	132 (53)	10–14	X	X	93	✓ ^{*a} /0		✓ ^a /0		
Helgeson, Lopez et al. (2009)	76 (50)	13–16	X	X	90	0		✓ ^b /0		
Smith et al. (1991)	37 (32)	11–18	X		NR		0			
DeDios et al. (2003)	55 (40)	M = 17	X		NR		0			
Pendley et al. (2002)	68 (62)	8–17	X		88		✓(1.15)/0			
Lehmkuhl & Nabors (2008)	81 (39)	8–14		X	100		✓ ^b			
Hains et al. (2007)	102 (60)	10–18	X		81		✓ ^{*d} /0			✓ ^d
Thomas et al. (1997)	67 (49)	8–17	X		79					0
Drew et al. (2010)	252 (54)	10–15		X	94					✓(.47)
Grey et al. (1998)	65 (57)	13–20		X	92					✓(.38)

Note. XS = cross-sectional; Long = longitudinal; Oth Peer Infl = other peer influences; effect sizes shown in the form of Cohen's *d* ✓ association found; ✓* association found in unexpected direction; 0, no association found; †,‡, studies are linked; NR = not reported.

^aBeta from MLM or HLM models—cannot calculate effect sizes.

^bStandardized beta not ± 0.50, cannot convert to *d* (Peterson & Brown, 2005).

^cInferential statistics not run—only averages reported.

^dMore complicated relation reported in text.

Schlundt et al., 1994). Schlundt et al. (1994) asked teens about obstacles to dietary adherence and found that several could be attributed to the actions or the presence of peers. Of the 10 clusters of obstacles identified in the study, two were directly related to peers (i.e., peer interpersonal conflict, eating at school), and three were likely to involve peers (i.e., competing priorities due to fear of social repercussions, social events and holidays, social pressures to eat inappropriate foods). A second study asked teens how they cared for themselves, what factors supported their care, and what factors hindered their care (Kyngas et al., 1998). Three categories arose from the interview responses that described peer relationships: dominant (teens like to live like their peers and are tempted to break healthcare regimens), silent support (peers adjust to the limitations of the teen with T1D), and irrelevant (peers have no influence on self-care). The third study asked open-ended questions about the context of diabetes-related problems that have occurred since beginning to use an insulin pump (Berlin, 2006). The most frequent context in which problems were reported by teens was in social situations with peers. A fourth study found that emotional support in the form of acceptance and encouragement from peers resulted in Swedish teens feeling secure incorporating self-care behaviors into their daily routines (Karlsson et al., 2008).

One study directly asked adolescents how peers influence how they take care of themselves, and if there were ways in which peers could be more supportive of diabetes self-care (Lehmkuhl et al., 2009). Although teens most frequently said that their self-care was not affected by the presence of peers and that peers' support behaviors were satisfactory, participants identified a number of ways in which peers could be more helpful: provide verbal reminders, monitor symptoms of hyper/hypoglycemia, and refrain from drawing attention to their diabetes.

Two other studies used a semi-structured interview, the Diabetes Social Support Interview (DSSI; La Greca, Auslander et al., 1995), to ascertain ways in which teens ages 11–18 years found peers to be helpful. Responses to open-ended questions, such as, "*In what ways do your family/friends provide support for [diabetes care tasks],*" were coded into categories of diabetes-specific instrumental (i.e., behaviors that providing assistance or resources for solving a problem) and emotional (i.e., behaviors that provide comfort, affirmation, or communicate caring) support. Teens reported that family members provided higher levels of diabetes-specific instrumental support than peers, whereas peers provided more diabetes-specific emotional support (e.g., companionship, acceptance) than parents. Support in the form of companionship from peers was most frequently mentioned in the contexts of exercise

and diet. When teens with T1D did report diabetes-specific instrumental support from friends, it was more likely to be for insulin administration and blood glucose monitoring than for diet and exercise.

Pendley et al. (2002) used the DSSI to examine whether the kind of support received from peers depended on adolescent age. Older adolescents (ages 13–17 years) reported more diabetes-specific instrumental support for taking insulin, testing blood glucose and diet and more emotional support from peers than younger children (ages 8–12 years). Interestingly, there were no differences between the two age groups in the kinds of support received from family.

These qualitative studies indicate that teens with T1D consider peers to have influence on their self-care behavior, but it is not clear whether this influence is positive or negative. In the next sections, we examine whether existing research supports teens' beliefs by reviewing the literature on the association of peer relationships to self-care and glycemic control. The descriptive characteristics and overall study findings are shown in the top half of Table I for self-care and in the bottom half of Table I for glycemic control.

Supportive Relationships and Diabetes Outcomes

General Support

Self-care. Three studies presented in four published reports examined the relation of general support to self-care, one of which resulted in separate cross-sectional and longitudinal reports. This study found a cross-sectional relation of general support to stronger dietary adherence, but not to insulin administration or blood glucose testing (Skinner & Hampson, 1998). In addition, a baseline measure of combined family and friend support predicted improvements in dietary self-care 6 months later, but did not predict changes in insulin administration or blood glucose monitoring after adjusting for illness duration, SES, and gender (Skinner, John, & Hampson, 2000). Increases in combined friend and family support over the 6 months also were associated with improvements in dietary self-care. The fact that investigators combined friend and family support into one variable, however, makes it impossible to determine whether friend support had a unique impact on self-care.

The second study did not find an association between a measure of general support and self-care behavior cross-sectionally or longitudinally using multilevel modeling after 1 year controlling for BMI, pubertal stage, and SES (Helgeson, Reynolds, Escobar, Siminerio, & Becker, 2007). A third study found no cross-sectional relation of general

support to self-care, but the number of enjoyable interactions with friends using ecological momentary assessment aggregated over 4 days was positively associated with self-care, especially for girls (Helgeson, Lopez, & Karmack, 2009). This study provided a different way to assess general peer support. Rather than relying on retrospective reports, proximal measures of social interactions over several days may have provided a more accurate representation of teens' social lives.

Glycemic Control. Three studies (four reports) examined the association of general support to glycemic control. One study found no correlation of general support to glycemic control (Kager & Holden, 1992). A second study found no association of general support to glycemic control cross-sectionally or longitudinally 1 year later using multilevel modeling and controlling for BMI, pubertal stage, and SES (Helgeson et al., 2007). In contrast, a follow-up study of the same sample showed that peer support was related to *poor* glycemic control over four annual assessments using multilevel modeling controlling for age, pubertal status, treatment delivery method, baseline SES, and baseline BMI (Helgeson, Siminerio, Escobar, & Becker, 2009). However, lagged analyses over 4 years that controlled for the same variables showed that peer support did not predict changes in glycemic control. Finally, the previously described ecological momentary assessment study of social interactions did not find a relation of an aggregate measure of enjoyable interactions over 4 days or retrospectively reported general support to glycemic control (Helgeson, Lopez et al., 2009).

Summary. Even though significant effects were strong to moderate, overall evidence to link general support to self-care is weak. With the exception of the one finding in the direction opposite of predictions, there was no evidence that general peer support was related to glycemic control, despite the variety of design approaches that were employed.

Diabetes-specific Support

Self-care. Nine studies (10 reports) examined the relation of diabetes-specific support to self-care. One study found no correlation of peer support to anticipated self-care difficulties (Hains et al., 2007). Three studies found no association of diabetes-specific support to self-care using MANOVA (La Greca, Auslander et al., 1995), multiple regression with controls for age with a mostly minority sample (Naar-King, Podolski, Ellis, Frey, & Templin, 2006), or multiple regression with controls for diabetes duration (Pendley et al., 2002). In addition, an

intervention using a small sample ($n=21$) with a wide age range (10–18) of adolescents aimed at increasing peer support and peer diabetes knowledge had no effect on self-care (Greco, Pendley, McDonell, & Reeves, 2001).

One study reported mixed findings. Diabetes-specific support from peers was correlated with good blood glucose monitoring, but not diet and insulin administration cross-sectionally (Skinner & Hampson, 1998), and neither a combined measure of family and friend diabetes-specific support nor changes in this measure were associated with changes in self-care behaviors over 6 months using multiple regression controlling for illness duration, SES, and gender (Skinner et al., 2000). As noted previously, the use of a combined measure of friend and family support in this follow-up study precludes our ability to draw strong conclusions.

In contrast, three studies found a link between diabetes-specific peer support and self-care. Using a quantitative adaptation of the DSSI, one study linked support for blood glucose testing on the Diabetes Social Support Questionnaire (DSSQ) to more frequent blood glucose testing, but did not link support for insulin administration or diet to their respective self-care behaviors when adjusting for age in multilevel modeling analyses (Bearman & La Greca, 2002). In addition, diabetes-specific support was not related to a general index of adherence. The second, a study of Finnish teenagers with one of four different chronic diseases (asthma, epilepsy, juvenile rheumatoid arthritis, diabetes), used logistic regression to show that adolescents who felt that peers supported their diabetes self-care behaviors were 2.11 times more likely to adhere to those behaviors (Kyngas & Rissanen, 2001). However, these investigators did not conduct separate analyses within specific disease groups. Finally, a study of Finnish teens examined the association of different categories of diabetes-specific support from peers to self-care. Peer support that was categorized as silent or irrelevant was associated with better self-care than peer support that was categorized as dominant (Kyngas et al., 1998). These findings are difficult to interpret, however, because no inferential statistics were used to determine whether there were group differences in compliance.

Glycemic Control. Five studies examined the relation of diabetes-specific support to glycemic control. One study found no correlation between more positive diabetes-related interactions with peers and glycemic control (Smith, Mauseth, Palmer, Pecoraro, & Wenet, 1991). Two studies found no relation of diabetes-specific support to glycemic control (de Dios, 2003), one of which controlled for adherence and diabetes knowledge using

multiple regression analysis (Pendley et al., 2002). However, the latter study also employed an indirect measure of diabetes-specific support by asking teens to identify peers who would participate in a “support team” for an intervention aimed at improving family and peer involvement in diabetes self-care (Pendley et al., 2002). Teens who chose a larger number of peers had better glycemic control. A large effect size for this relation indicated a strong association.

One study measured teens’ satisfaction with school support for diabetes (including peer support) and found that higher satisfaction predicted improved glycemic control over 6 months using regression, but only for those teens with better glycemic control at baseline (Lehmkuhl & Nabors, 2008). The last study employed structural equation modeling, found no direct association of support to glycemic control, but found that support moderated the association between diabetes-related stress and glycemic control (Hains et al., 2007). Surprisingly, as peer support increased, the link of diabetes-related stress to poor glycemic control grew stronger.

Summary. Of the 9 studies, 4 found relations between diabetes-specific peer support and self-care. Those four had heterogeneous designs relative to each other compared to the five that did not find relations. Two of the studies that found relations were quite different from the others—one included teens with diseases other than diabetes, and one used descriptive statistics from a primarily qualitative measure. Thus, even considering moderate effects for two of these four findings, the link of diabetes-specific support to self-care is relatively weak.

Although more complicated designs were more likely to find relations of diabetes-specific support to glycemic control, the overall evidence is weak. The majority of the studies found no effects but the few that did find effects had moderate to large effect sizes. Significant relations typically linked supportive peer relations to good glycemic control, with two exceptions that found a detrimental relation. These two studies have little in common, and are indistinguishable from other studies, thus offering no explanation for their unexpected findings.

Social Conflict and Diabetes Outcomes

General Conflict

Self-care. Two studies examined peer conflict as a predictor of self-care. One found no relation of peer conflict to self-care behaviors cross-sectionally or longitudinally using multilevel modeling over 1 year controlling for BMI, pubertal stage, and SES (Helgeson et al., 2007). The second study had mixed findings. Peer conflict was associated

with worse self-care behavior cross-sectionally, but an ecological momentary assessment of peer conflict revealed that an aggregate measure of upsetting peer interactions over 4 days was not related to self-care behavior (Helgeson, Lopez et al., 2009).

Glycemic Control. These same two studies (three reports) also examined the relation of peer conflict to glycemic control. Both found an association of higher levels of peer conflict to poor glycemic control. In a cross-sectional study, conflict with peers was associated with poor glycemic control, especially for girls (Helgeson, Lopez et al., 2009). However, the ecological momentary assessment portion of the study did not reveal a relation of an aggregate measure of upsetting peer interactions over 4 days to glycemic control. In a second study, conflict with peers was associated with poor glycemic control cross-sectionally at baseline, and predicted a decline in glycemic control over 1 year using multilevel modeling with controls for BMI, pubertal stage, and SES (Helgeson et al., 2007). In a follow-up report of this same sample, multilevel modeling showed that peer conflict was unrelated to glycemic control over a 4-year period in concurrent analyses, but that peer conflict predicted deterioration in glycemic control in lagged analyses over the same 4 years (Helgeson, Siminerio et al., 2009).

Diabetes-Specific Conflict

Although qualitative studies found that teens with T1D mentioned diabetes-specific conflict as detrimental to self-care, we could not locate any studies that examined the relation of diabetes-related conflict to self-care or glycemic control.

Summary. The existing studies, while small in number, suggest that general peer conflict may adversely affect self-care and metabolic control. The two studies that support this conclusion used different designs, but were conducted by the same laboratory. Thus replication is needed before strong conclusions can be drawn. We did not locate any studies that examined diabetes-specific conflict in connection to self-care or glycemic control.

Other Peer Influences and Diabetes Outcomes

Self-care. Four studies examined associations of other peer influences to self-care behavior, three of which found a relation. The first used an innovative design in which teens ages 8–17 years were asked how they would respond to vignettes of situations that posed self-care dilemmas (Thomas, Peterson, & Goldstein, 1997). Across the five vignettes, older teens stated they would be more likely to choose less adherent behaviors in the face of social

pressures in spite of a more accurate understanding of appropriate self-care behaviors than younger teens. The second study examined vulnerability to peer influence by asking teens how they imagined peers would react to the execution of their self-care behaviors in social situations. When teens anticipated negative reactions from peers, they were more likely to say that they would have trouble with self-management (Hains et al., 2007).

The third study investigated the role of peer influence by measuring an individual difference variable called extreme peer orientation (EPO) that reflects whether teens were more or less vulnerable to peer influence. This study used regression analysis to find that teens who scored high on EPO reported worse self-care behaviors (Drew, Berg, & Wiebe, 2010).

The fourth study examined whether adolescents can learn skills that would help them face challenging situations around peers. When randomly assigned to an intervention group that involved coping skills training for resolution of diabetes-related social dilemmas or a control group, there was no evidence that the intervention group improved testing or insulin administration over 3 months (Grey et al., 1998). The investigators did not examine other self-care behaviors that could have been affected by the training, such as diet and exercise.

Glycemic Control. The same four studies also examined links to glycemic control. Three of the four found a relation. The vignette study found no relation of responses to situations that posed challenges to diabetes to glycemic control (Thomas et al., 1997). In contrast, the study that examined teen perceptions of peer reactions (Hains et al., 2007) found an indirect link to glycemic control. Specifically, teens who expected negative reactions from peers regarding their self-care anticipated self-care difficulties, which were associated with increased diabetes-related stress, which, in turn, was linked to worse glycemic control. Third, the intervention to address social dilemmas showed a benefit for glycemic control (Grey et al., 1998).

Finally, the study that examined vulnerability to peer influence found a link of EPO to poor glycemic control (Drew et al., 2010). EPO was also found to mediate the relation between strong parental relationships and glycemic control, such that good relationships with parents were associated with good self-care behavior and good glycemic control in the presence of lower EPO. These findings suggest that a balance between the importance placed on family versus peer relationships may be one key to optimal diabetes outcomes in this age group.

Summary

Taken collectively, these four studies provide the strongest links of peer relationships to self-care and glycemic control in the literature reviewed, with effect sizes in the moderate to strong range. Each study considers attributes or skills of teens in conjunction with their environment.

Discussion

Previous reviews have acknowledged the importance of examining social support and its influence on diabetes and other health outcomes (La Greca, Bearman, & Moore, 2002; Wysocki & Greco, 2006), but this is the first review to our knowledge to focus exclusively on peer relationships and their link to self-care and glycemic control in adolescents with T1D. Previous reviews have concluded that peer support has a positive impact on adolescent disease outcomes (La Greca et al., 2002; Wysocki & Greco, 2006). The qualitative studies included in this review provide clear evidence that teens with T1D believe peers influence their self-care behavior, but this review found a weak relation between peer support and self-care, and mixed evidence linking peer support to glycemic control.

The majority of studies examining the association of peer support with self-care found no link of general or diabetes-specific support to global self-care indices. Although our intention at the outset of this review was to examine the relation of different kinds of peer support to self-care and glycemic control, specifically distinguishing between emotional and instrumental support, studies failed to distinguish between the two within the context of general or diabetes-specific support. Of the studies that did find a relation between support and self-care, all associated higher levels of support with better self-care behaviors. Two of the five found an association with a specific self-care behavior (e.g., diet, blood glucose monitoring) rather than with a global index of self-care behaviors. Four of the five found a link of diabetes-specific support to self-care. Together, these findings suggest that links of support to self-care require consideration of diabetes-specific predictor variables and specific aspects of self care. It also may be the case that certain types of support have a stronger influence on specific self-care behaviors, as argued previously by La Greca (1995). For example, reminding teens to test their blood sugar (i.e., diabetes-specific instrumental support) may be more strongly related to blood glucose monitoring, and helping teens feel good about themselves despite dietary restrictions (i.e., diabetes-specific emotional support) may be more strongly linked to diet.

Evidence for a link between peer support and glycemic control among adolescents is mixed. The majority of the studies found no relation between peer support and glycemic control. Of the two studies that found a beneficial association, one found that satisfaction with school support predicted an improvement in glycemic control, but only for those who had better glycemic control at baseline (Lehmkuhl & Nabors, 2008), and the other linked the number of peers selected to participate in an intervention to better glycemic control (Pendley et al., 2002). These measures of support are unique relative to the other support measures used. In addition, two studies indicated that peer support was associated with poor rather than good glycemic control, one of which found a direct link (Helgeson, Siminerio et al., 2009), and one of which showed an indirect link in which peer support intensified the negative relation between diabetes-related stress and glycemic control (Hains et al., 2007). Consequently, it is difficult to conclude that peer support is beneficial in terms of glycemic control.

Despite the fact that there were fewer studies that examined the negative compared to the positive side of peer relationships, more consistent evidence relates peer conflict, rather than support, to diabetes outcomes. Interestingly, it was general conflict rather than diabetes-related peer conflict that was examined in these studies. The two studies that linked general conflict to poor glycemic control are especially important, because both were longitudinal.

Why would general peer conflict be associated with poor diabetes outcomes? First, conflict with peers can lead to increased levels of interpersonal stress for teens, who are already involved in a wide variety of challenges from school and other activities. Stress can detract from self-care and directly or indirectly affect glycemic control. Research has shown that stress is associated with poor self-care and poor glycemic control among youth with diabetes (Helgeson, Escobar, Siminerio, & Becker, 2010). Second, peer conflict could be a reflection of low social competence. Youth who are less skilled at negotiating and adapting to their social environment may face more difficulties in their relationships. Social competence has been linked to better health among adolescents in general (Mechanic & Hansell, 1987) and to better self-care in teens with diabetes (Miller & Drotar, 2006); it also mitigates the detrimental relation of stress to metabolic control (C. L. Hanson, Henggeler, & Burghen, 1987). Therefore, teens who lack the advantage of social competence may be more prone to health-related difficulties. Third, adolescents experiencing conflict may be reluctant to discuss their diabetes with peers (Jacobson et al., 1986), which could lead

to neglect of self-care around peers. Newly diagnosed teens who said they did not plan to share their diabetes with their friends at baseline had poorer self-care behavior and poorer adjustment 3 months later (Greco et al., 2003). In contrast, teens who had more peers in school who were aware of their diagnosis reported fewer concerns about diabetes self-management in the presence of peers (Salamon, 2010). Fourth, in the case of severe conflict (i.e., bullying), teens may be neglectful of their diabetes self-care in public situations to avoid being singled out (Susman-Stillman, Hyson, Anderson, & Collins, 1997).

We do not know, however, whether general peer conflict or diabetes-specific conflict are more strongly related to diabetes health outcomes because, surprisingly, not a single study examined the relation of diabetes-specific conflict with peers to self-care or glycemic control. Despite the fact that qualitative research indicated peers can present challenges to self-care behaviors, researchers have not used an instrument that taps diabetes-specific conflict to explore its association to diabetes outcomes. Although instruments measuring diabetes-related family conflict, such as the Diabetes Family Conflict Scale (DFCS; Hood, Anderson, Butler, & Laffel, 2007; Rubin, Young-Hyman, & Peyrot, 1985), are widely used in pediatric research, no instrument exists that specifically taps diabetes-related peer conflict. Some measures of diabetes-related support include conflict items, such as the Diabetes Family Behavior Scale (DFBS; McKelvey et al., 1993) and the Diabetes Family Behavior Checklist (DFBC; Schafer, McCaul, & Glasgow, 1986), but they do not examine the conflict items separately from the support items. The Diabetes Stress Questionnaire (DSQ; Salamon, 2010) is a recently developed measure of diabetes-related stress that teens may experience in social situations, but to date it has not been examined with respect to self-care or glycemic control.

The strongest overall evidence that peer relationships are linked to diabetes outcomes arose from studies that considered both the personalities of youth and the context of the situations they faced. Teens may be more or less influenced by peers for reasons that have little to do with peers, but more to do with their own dispositions and coping skills and styles. The key to assisting teens to cope effectively with social situations must consider the adolescent's cognitive framing of social challenges in conjunction with the social environment. Three studies considered how the dispositions or cognitions of adolescents with T1D interacted with the social environment. Peer relationships were linked to poor self-care behaviors when those relationships were examined in the context of social situations that pose challenges to self-care for older, more knowledgeable teens (Thomas et al., 1997), when an

individual difference variable was developed that tapped hyper-responsiveness to peer relationships (Drew et al., 2010), and when the respondent's perception of peer reactions was taken into consideration (Hains et al., 2007). Similar findings appeared for glycemic control. Interestingly, an intervention that trained newly-diagnosed adolescents with T1D to deal with difficult diabetes-related social situations led to steeper improvements in glycemic control over time compared to controls.

Together, the findings relating peer influence to diabetes self-care and glycemic control are inconclusive. Although the majority of studies showed no relation, there were some notable patterns in the findings. When a relation of peer support to self-care was found, it was more likely to be positive and to involve diabetes-specific support and specific self-care behaviors. Associations of peer support to glycemic control were provocative, in that there were equal numbers of beneficial and harmful relations. Drawing overall conclusions from these studies is difficult, however, because many more studies assessed self-care behavior than glycemic control. Peer conflict, on the other hand, was more consistently related to poor self-care and poor glycemic control, but fewer studies examined peer conflict and none examined diabetes-specific conflict. Finally, when considering participant dispositions and cognitions in social context, peer influence was typically linked to poor diabetes outcomes. The next section addresses limitations that may have contributed to these mixed findings and provides recommendations for how future research can extend knowledge regarding peer influence on teens with T1D.

Limitations of Past Research and Future Directions

Future research on the impact of peers on diabetes outcomes might benefit from different ways of conceptualizing peer relationships. One potentially important distinction is the one between friends and peers. The distinction between friends and peers has been studied in the developmental literature (Berndt, 2002; La Greca & Harrison, 2005). Despite recommendations that this distinction be considered in pediatric health research (La Greca et al., 2002), the differential influence of friends versus peers rarely has been examined in the context of T1D. Only one study explicitly distinguished between friends and peers (Hains et al., 2007), and only for a portion of the measures used. When asked how participants thought friends and peers would react to their self-care behaviors, the distinction did not make a difference. However, these

researchers did not distinguish between friends and peers when examining peer support. Peers are individuals of the same age, grade, or social status as the teen, whereas classifying a peer as a friend suggests a person who the teen likes, trusts, and spends time. It may not be friends who pose challenges to diabetes self-care, but other classmates and acquaintances with whom the teen has substantial contact. Since the closeness of friendships changes throughout adolescence, however, it may be difficult for teens to distinguish friends from peers.

Another way of conceptualizing peer relationships is to examine the characteristics of teens' social networks. Recall that one study showed that teens who chose a greater number of peers to participate with them in an intervention had better glycemic control (Pendley et al., 2002). This finding suggests that simply being embedded in a larger social network is beneficial to diabetes health. However, it is also possible that larger social networks could lead to more peer pressure and detrimental influence on self-care and, subsequently, poor glycemic control, especially if teens are overly concerned with peer acceptance as was found in the case of EPO (Drew et al., 2010). Recall the two studies that linked peer support to poor glycemic control (Hains et al., 2007; Helgeson, Siminerio et al., 2009). Peer support in these studies could have reflected embedding in a social network that made it difficult to resist peer influence. Future research should assess characteristics of peer social networks including network size, diversity, and strength to ascertain their associations with diabetes outcomes.

Peer relationships should also be considered in the context of the family environment. Research has shown that strong parent-adolescent relationships are more likely to be linked to good self-care and glycemic control when teens do not place excessive importance on peer acceptance (Drew et al., 2010). Research has also shown that friendships of teens with chronic diseases are protective from negative effects of poor parental relationships, but that there are limits to the role that parental relationships can play in alleviating negative effects of problematic relationships with friends (Herzer, Umfress, Aljadef, Ghai, & Zakowski, 2009). This synergistic influence of friends and family relationships on teens' well-being suggests that peer influence should be examined within the context of the quality of familial relationships.

Future research that examines the association of peer relationships to diabetes outcomes also would benefit from an examination of several variables that have implications for teens' relationships—specifically age, gender, and SES. Since peer relationships change over the course of adolescence (Berndt, 1979; McNelles & Connolly, 1999), the

implications of peer relationships for diabetes self-care also may change with age. Older teens report more support from peers than children (Pendley et al., 2002), but also are more vulnerable to peer influences than children (Thomas et al., 1997). Researchers typically studied children and adolescents across a wide variety of ages (i.e., 10–18 years) without determining whether age moderated links of peer relations to diabetes outcomes. Findings based upon youth across multiple stages of development may fail to identify a stage of social development in which peers have an important influence.

Gender is another variable that should be considered more prominently in future research. Studies show that girls report more diabetes-specific support (Bearman & La Greca, 2002; La Greca, Auslander et al., 1995; Skinner & Hampson, 1998; Skinner et al., 2000) and more general support (Helgeson, Reynolds, Shestak, & Wei, 2006; Skinner & Hampson, 1998; Skinner et al., 2000) than boys. However, it is not clear whether sex affects the role that peer relationships play in self-care and glycemic control. The one study that examined this issue found that peer conflict was more strongly associated with poor glycemic control among girls than boys (Helgeson, Lopez et al., 2009).

Peer influence on teens with T1D may also depend upon SES. Lower SES has been associated with poorer health (e.g., smoking, poorer diets, less physical activity; M. D. Hanson & Chen, 2007; Matthews, Gallo, & Taylor, 2010; Wilkinson, 1992). In the context of diabetes, teens from lower SES households may experience less frequent adult supervision than those from more affluent households, leading them to be more susceptible to peer influence (Evans, 2004). Simply adjusting analyses for SES is not enough to capture its important influence on health (Adler et al., 1994). None of the studies that we reviewed examined whether findings held across different SES groups.

Finally, two other methodological limitations may have contributed to the lack of clear findings. First, all but one of the studies reviewed (Naar-King et al., 2006) employed relatively homogeneous samples of adolescents with regard to race, ethnicity, and SES. This lack of representative samples limits the generalizability of the findings. Minority races and cultures place greater importance on family and community than whites (Ajrouch, Antonucci, & Janevic, 2001; Siddiqui, Mott, Anderson, & Flay, 1999), and this difference could result in lower rates of peer influence among minority teens. Second, the majority of study designs were cross-sectional, limiting the ability to draw conclusions about causality. It is important to determine if peer relationships impact diabetes-related

behaviors, if diabetes-related behaviors impact peer relationships, or if third variables influence the relationship.

The study of peer influences on self-care and glycemic control in adolescents with T1D is at an exciting crossroads. Qualitative studies have established that teens believe peers influence their self-care, but quantitative studies have yet to provide conclusive evidence as to the nature of this influence. Clear methodological limitations, the lack of measurement specificity, and the paucity of research addressing the problematic aspects of peer relationships are problems that can be remedied. Different conceptualizations of peer support, such as discerning friends from peers, and more carefully examining peer network characteristics, provide many opportunities for further investigation. Learning to navigate their social environments while coping with the requirements of a chronic disease is an important developmental task for teens with T1D, and may have an important impact on health outcomes. Whether the peers of teens with T1D are friends or foes with regard to their impact on diabetes outcomes remains to be determined.

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