

# Psychosocial Therapies in Diabetes

## Report of the Psychosocial Therapies Working Group

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**OBJECTIVE** — To review key advances in the behavioral science literature related to psychosocial issues and therapies for persons with diabetes, to discuss barriers to research progress, and to make recommendations for future research.

**RESEARCH DESIGN AND METHODS** — Key findings from the literature on psychosocial research in diabetes are reviewed separately for children and adults. Specific issues covered include psychosocial adjustment and psychiatric disorders, neurocognitive functioning, quality of life, and psychosocial therapies. Barriers that must be addressed to allow research in this area to progress are discussed. Recommendations are then made concerning high-priority areas for advancing research in the field.

**CONCLUSIONS** — A substantial amount of behavioral science research has demonstrated that psychosocial factors play an integral role in the management of diabetes in both children and adults. Research has also shown the efficacy of a number of psychosocial therapies that can improve regimen adherence, glycemic control, psychosocial functioning, and quality of life. More research in this area is needed to develop psychosocial intervention programs for specific patient populations and to demonstrate the cost-effectiveness of these approaches.

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This study presents the summary and recommendations of the Psychosocial Therapies Working Group, originally presented at the conference on Behavioral Science Research in Diabetes, held in November 1999, at the National Institutes of Health. In this study, we first highlight the significance of psychosocial issues in diabetes care and key advances in the field separately for children, adolescents, and adults. This review of the literature in this area is not intended to be detailed and comprehensive; several other literature reviews of behavioral and psychosocial research in diabetes have been published in recent years (1–4). Our

objective is to provide examples of key findings from the field of behavioral research addressing psychosocial issues and therapies. We then discuss barriers to research progress and conclude with specific recommendations for future research.

### CHILDREN AND ADOLESCENTS

#### Significance

The incidence of type 1 diabetes in young children has increased in recent years (5,6). In addition, the incidence of type 2 diabetes has been increasingly recognized in older children and adolescents, often in

association with obesity (7). Large numbers of children are currently affected by diabetes, and many more will be affected by diabetes in the future.

Diabetes imposes considerable demands on children and their families. Because they are coping with normal developmental challenges, the additional burden of diabetes may be difficult for many children to deal with effectively. Especially burdensome may be the demands of intensive management. With children as patients, families play a significant role in diabetes management and are instrumental in the implementation of interventions. Diabetes can adversely affect both psychosocial and neurocognitive functioning, thus potentially affecting the quality of life of the child and the entire family. Psychosocial factors can also influence regimen adherence and glycemic control. Therefore, psychosocial factors are very important to consider in the management of children and adolescents with diabetes.

#### Key findings

**Psychosocial functioning.** Research indicates that type 1 diabetes is a risk factor for the development of psychiatric disorders in children and adolescents. Many children have adjustment problems soon after the diagnosis of diabetes (8,9). Although most children resolve these problems within the first year, children who do not are at risk for poor adaptation to diabetes, including regimen adherence problems, poor metabolic control, and continued psychosocial difficulties (10–12). In addition, many mothers of newly diagnosed children are at risk for adjustment problems of their own, with significant depressive symptoms observed in approximately one third of mothers; most of these abate within the first year after their child's diagnosis (13).

A study of adolescents with diabetes found that one third had psychiatric disorders, most involving internalizing symptoms (14); other studies have shown that diabetic youth have greater rates of depression (15) and that those with depression have poor glycemic control (16).

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A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

A 10-year longitudinal study found that nearly half of the study sample had a psychiatric diagnosis, the most frequent of which was depression (17). Another 10-year longitudinal study found lower self-esteem among young adults with diabetes (18). Poorer psychological adjustment during adolescence may persist into adulthood (19).

Research has also shown that diabetic youth, particularly adolescent girls, are at increased risk for eating disorders. Both eating disorders and subclinically disordered eating attitudes and behaviors (e.g., severe dietary indiscretion and repeated insulin omissions) have been observed in adolescent girls with diabetes and are associated with worse metabolic control (20,21). At least 10% of adolescent girls with type 1 diabetes meet diagnostic criteria for an eating disorder, a rate twice as high as in girls without diabetes (21). Without intervention, disordered eating and insulin manipulation may worsen over time and increase the risk of health complications (22).

**Neurocognitive functioning.** Studies indicate that children who develop diabetes before 5 years of age and/or who have frequent episodes of hypoglycemia are at risk for neurocognitive deficits, particularly in visual-spatial functioning (23–25). In addition, research findings indicate that children with diabetes miss more school than peers without diabetes and that lower reading achievement was related to more school absences (26). Studies have also shown that diabetic children, especially boys, are more likely to have learning problems (27).

Other research has found poorer attentional functioning and lower verbal intelligence in children with a history of significant hypoglycemia (28). A longitudinal study of newly diagnosed children revealed declines in verbal intelligence and school grades, predicted in part by memory dysfunction (29,30). Another study showed that 2 years after diagnosis, children exhibited mild neuropsychological deficits, including reduced speed of information processing, and decrements in conceptual reasoning and acquisition of new knowledge (31), which were predicted by both recurrent hypoglycemia and hyperglycemia, as well as early onset of diabetes (before 5 years of age) (32).

**Quality of life.** Relatively few studies have specifically examined quality of life in children and adolescents with diabetes

(33). Quality of life in individuals with diabetes can be reliably measured by self-report (34). Research findings indicate that better quality of life in youths is associated with increased self-efficacy and less depression (35), as well as improved metabolic control (36).

**Psychosocial factors related to regimen adherence and metabolic control.** Research has shown that regimen adherence declines over time and is especially poor among some adolescents (37,38). Metabolic control has been noted to be worse in single-parent, lower-income, African-American youths (39–41).

Family factors are significantly associated with regimen adherence and metabolic control in children and adolescents. For example, low levels of family conflict and stress, high levels of cohesion and organization, good communication skills, and appropriate involvement of both parents and children in diabetes management have been associated with higher levels of regimen adherence (42,43) and better metabolic control (44–47). When parents allow adolescents to have self-care autonomy without sufficient cognitive and social maturity, they are likely to have more problems with diabetes management (48,49).

Research has also examined the role of stress and coping in relation to diabetes management. Children who have less life stress (46) and who cope well with diabetes management are more likely to have fewer problems with regimen adherence (50) and metabolic control (51).

Adolescents' health beliefs are related to their regimen adherence and glycemic control. In particular, high levels of self-efficacy (52) and low levels of learned helplessness (53) have been associated with good glycemic control. Specific health beliefs related to the seriousness of diabetes, personal vulnerability to complications, costs of regimen adherence, and beliefs in the efficacy of treatment have also been associated with both regimen adherence and glycemic control (54). Similarly, studies with younger children have shown that their health beliefs are related with adherence and glycemic control (55).

**Psychosocial therapies.** A number of controlled studies have examined the efficacy of psychosocial interventions for diabetic youth. Most of these have included the family as an integral part of treatment. Research findings indicate that

family-based behavioral procedures such as goal-setting, self-monitoring, positive reinforcement, behavioral contracts, supportive parental communications, and appropriately shared responsibility for diabetes management have improved regimen adherence and glycemic control (56,57). In addition, such interventions can improve the parent-adolescent relationship (56,58). Psychoeducational interventions with children and their families that promote problem-solving skills and increase parental support early in the disease course have improved long-term glycemic control of children (59).

The efficacy of group interventions for diabetic youth has also been systematically evaluated. For example, research findings have shown that peer group support and problem-solving have improved short-term glycemic control (60,61). Group coping skills training has been shown to help optimize glycemic control and quality of life for adolescents involved in intensive insulin regimens (62,63). In addition, stress management and coping skills training has reduced diabetes-related stress (64) and improved social interaction (65) in adolescents.

## ADULTS

### Significance

Diabetes is a psychologically and behaviorally demanding disease; therefore, psychosocial factors are relevant to nearly all aspects of its management. The psychosocial impact of diabetes has been recognized as a stronger predictor of mortality in diabetic patients than many clinical and physiological variables (66). Considering the importance of psychosocial factors in management of diabetes, the rapidly increasing number of adult patients with diabetes (mostly type 2), and the tremendous and growing public health burden of diabetes, the development and clinical implementation of effective psychosocial interventions are critical needs. Such interventions could help patients improve self-care behaviors and glycemic control, thus reducing their risk of health complications and improving their quality of life.

### Key findings

**Psychosocial functioning.** Substantial literature documents the prevalence and course of psychiatric disorders, particularly affective and anxiety disorders, in

adults with diabetes (3). Research findings have demonstrated that depression is more common in patients with diabetes than in the general population; at least 15% of patients have clinical depression (67,68). Findings indicate that depression is associated with worse glycemic control and health complications (69,70), as well as decreased quality of life (71), and is likely to be persistent (72). A recent meta-analysis confirms the association of depression with hyperglycemia and complications in both adult type 1 and type 2 diabetes (73). Evidence from prospective studies indicates that depression doubles the risk of the incidence of type 2 diabetes, independent of its association with other risk factors (74,75). In patients with preexisting diabetes, depression is an independent risk factor for coronary heart disease and seems to accelerate its presentation (76). Research has also shown that anxiety disorders are common in adults with diabetes and linked with poor glycemic control (68,77).

There is promising evidence that some of the adverse effects of depression and anxiety on diabetes are reversed by psychiatric treatment. Randomized controlled intervention trials have shown that treatment with either cognitive behavior therapy or antidepressant medication (nortriptyline or fluoxetine) can improve both mood and glycemic control (78,79). Psychopharmacologic interventions have been shown to reduce anxiety and improve glycemic control (80).

Studies indicate that eating disorders such as bulimia are common in adults with diabetes, especially young women with type 1 diabetes (81). Moreover, research has demonstrated that eating disorders are associated with poor glycemic control (82) and increased risk for retinopathy (22).

Research has also examined the effects of the social environment on diabetes management. For example, greater levels of social support, especially diabetes-related support from spouses and other family members, has been associated with better regimen adherence (83). High levels of environmental stress have been linked with lower regimen adherence (84) and poor glycemic control (84–86), but the effects of stress seem idiosyncratic and depend on a number of patient and situational factors, including the type of stressor and coping response and the prestress metabolic parameters.

Evidence also suggests that social support may buffer the negative effect of environmental stress on blood glucose (87).

Research has also examined the potential role of stress in the etiology of type 2 diabetes. For example, experimental studies with the *ob/ob* mouse have shown that environmental stress interacts with obesity to promote glucose intolerance (88). This hyperglycemic stress response is attenuated by anti-anxiety drugs and can be classically conditioned (89,90). Recent human studies support the idea that stress may increase the risk for type 2 diabetes (91).

**Neurocognitive functioning.** Neurocognitive deficits have been observed in adults with type 1 diabetes, particularly those with at least five episodes of severe hypoglycemia (92), and in patients with peripheral neuropathy (93). Among older adults with type 2 diabetes, cognitive deficits have been reported in association with poor glycemic control (94).

**Quality of life.** Diabetes-related quality of life can be reliably measured (95–97). Studies have shown that quality of life in adults with diabetes is positively affected by increased physical activity and adequate social support (98). Improved quality of life has also been demonstrated after intensification of insulin regimens, an effect attributed to patients' greater perceived flexibility in physical activities and diet (99). Quality of life is adversely affected by the presence of comorbid psychiatric disorders and health complications (71,100), as well as physical complaints and worries about the future (95). In addition, research has shown that quality of life is diminished when diabetes-specific health behaviors are associated with a sense of burden (101). When used as measures of treatment outcome, studies indicate that disease-specific quality-of-life measures are more sensitive to changes over time than are more general measures of health-related quality of life (102,103).

**Psychosocial therapies.** A number of controlled studies have evaluated the effects of psychosocial interventions for adults with diabetes. A recent meta-analytic review of diabetes self-management interventions indicated significant improvements in glycemic control, as well as reductions in diabetes-related hospitalizations and health care costs, particularly when interventions in-

corporated individually tailored strategies to change behavior (104).

For example, interventions that increase patients' sense of empowerment and self-management skills have resulted in improvements in self-efficacy, self-care behaviors, glycemic control, patient satisfaction, and quality of life (105–108). These benefits have also been found in studies with older minority patients with type 2 diabetes (109,110). Studies of blood glucose awareness training have shown that patients with type 1 diabetes can reduce the frequency of severe hypoglycemia episodes, diabetic ketoacidosis, and automobile accidents, as well as the fear of hypoglycemia (111).

## **BARRIERS TO RESEARCH PROGRESS**

— A number of barriers exist that must be overcome for progress in research to continue. Most studies of personal and family factors in relation to adherence have relied on cross-sectional designs and self-report measures. There is a need for more longitudinal research that incorporates a variety of measurement approaches. In particular, studies of long-term psychosocial and behavioral functioning have not typically been conducted, especially with intensive insulin therapies. Intervention studies have, for the most part, been efficacy trials using small samples conducted at individual research sites. These relatively small sample sizes at individual research sites have limited the ability to study interventions that target specific patient groups (i.e., those that differ by age, gender, ethnicity, socioeconomic status, family structure, duration of diabetes, and presence of psychiatric disorders and health complications).

Improved glycemic control has been perceived as the single critical measure of treatment effectiveness. Although glycemic control is a major focus of intervention efforts, other types of outcomes, including regimen adherence, psychosocial functioning, and quality of life, are also worthwhile targets for intervention. In addition to focusing on outcomes for individual patients, other targets should include family relationships, work settings, and community-wide factors related to diabetes care.

Little consideration has been given thus far to psychosocial factors related to the use of new technologies in diabetes care, both as predictors and as conse-

quences of their clinical application. For example, screening for early markers of type 1 diabetes (islet cell antibodies) or genetic risks poses potentially significant psychosocial effects; however, relatively few studies have addressed these issues in clinical trials. Similarly, with the recent use of insulin pumps, new methods for inhaled delivery of insulin, and islet cell transplantation, psychosocial factors are not routinely considered in research designs.

Little attention has been paid to cost-effectiveness and efficiency in “real-world” clinical settings, and very few studies have systematically examined the translation of efficacious psychosocial intervention programs to clinical settings.

## RECOMMENDED RESEARCH PRIORITIES

### Children and adolescents

For children and adolescents, more longitudinal studies are needed to determine causal relationships among psychosocial factors, regimen adherence, and metabolic control. Intervention studies should include larger samples of patients from specific populations; this may require the use of multicenter studies. In particular, studies should focus on children and adolescents at developmentally critical transition times (newly diagnosed, very young preschool-aged children, preadolescent transition to adolescence, late adolescent transition to adulthood) during which preventive interventions can be provided. Research should also focus on high-risk patients (such as those with persistently poor regimen adherence and metabolic control), patients from low-income, single-parent families, and children with psychopathology (depression, eating disorders) and/or family dysfunction.

In this era of intensive therapies to achieve optimal glycemic control, more research is needed to determine the best ways to help children and their families succeed with intensive insulin therapies, both with multiple daily injections and with insulin pumps. It is also important to determine ways to prevent severe, recurrent hypoglycemia, particularly for patients on intensive insulin regimens. This is important because, on one hand, there is an association of hypoglycemia with neurocognitive deficits, and on the other hand, there is increasing use of intensive insulin regimens to reduce hyperglycemia.

Research is needed to determine the clinical significance of neurocognitive problems in children and adolescents, which may be related to both the history of glycemic control and age of onset of diabetes.

Research should particularly focus on the delivery of culturally sensitive interventions, especially with the expected growth of minority populations. This is especially relevant, considering that minority patients with type 1 diabetes are more likely to have poor metabolic control and considering the increased incidence of type 2 diabetes or impaired glucose tolerance among minority adolescents. Because few research findings are available concerning behavioral and psychosocial issues and therapies for the prevention and treatment of type 2 diabetes in youth, this area is considered a high priority. With all the different patient populations, there should be more use of theoretical models to guide intervention research.

Other research priorities are integrating behavioral and psychosocial services into routine pediatric diabetes care in clinical settings and addressing issues such as clinical significance, social acceptability, and cost-effectiveness. Such studies should include long-term follow-up to demonstrate maintenance of behavior change and positive health outcomes, as well as positive impacts on psychosocial functioning and quality of life. In addition to consideration of individual patients' functioning, it is also important to consider family relationships as outcome measures of psychosocial therapies.

More research focusing on dissemination and training is needed. In particular, such research should focus on the best strategies to educate health care providers about the importance of behavioral and psychosocial issues in treating children and their families and to train interventionists in implementation of efficacious treatment programs for selected patient groups.

### Adults

More studies should focus on the identification of specific psychosocial factors that influence regimen adherence and glycemic control in adults with type 1 and type 2 diabetes. Such studies should incorporate large patient samples and use longitudinal designs. For example, longitudinal studies can determine mechanisms

to account for how psychosocial factors and health behaviors affect health over time. Results from such studies can inform the development of more effective interventions for specific patient populations.

Sample sizes should be sufficient to have the power to detect effects among various patient subgroups. Specific patient populations include ethnic minorities, individuals with low socioeconomic status, the elderly, individuals who live alone or without social and family support, and individuals with psychiatric disorders and/or diabetes-related health complications. Considering the frequency of psychiatric disorders, research must establish methods of effective intervention with patients who have depression, anxiety, and eating disorders. More research is needed to assess how to improve self-management skills, empowerment, coping skills, and stress management to promote long-term health and quality of life for these special patient populations. Theory-based intervention studies are needed to determine how to individualize (i.e., tailor) psychosocial therapies to improve regimen adherence, glycemic control, and quality of life in the different patient populations.

Another research priority is conducting multicenter clinical trials to document the efficacy of initial findings drawn from smaller, single-site intervention studies. Research should be conducted that evaluates the integration of psychosocial intervention into disease management program, e.g., by targeting high-risk patients. Cost-effectiveness trials in “real-world,” managed care settings are needed to assist in the translation of research findings to clinical practice. The effectiveness of behavioral and psychosocial interventions must be demonstrated in clinical settings and shown to be cost-effective for more widespread implementation of these therapies to occur.

**CONCLUSIONS**— A substantial amount of behavioral science research has demonstrated that psychosocial factors play an integral role in the management of diabetes in both children and adults. Research has demonstrated the efficacy of a number of psychosocial therapies that can improve regimen adherence, glycemic control, psychosocial functioning, and quality of life. More research in this area is needed to develop psychosocial in-



tervention programs for specific patient populations and to demonstrate the cost-effectiveness of these approaches.

References

1. Cox DJ, Gonder-Frederick L: Major developments in behavioral diabetes research. *J Consult Clin Psychol* 60: 628–638, 1992
2. Glasgow RE, Fisher EF, Anderson BJ, La Greca A, Marrero D, Johnson SB, Rubin RR, Cox DJ: Behavioral science in diabetes: contributions and opportunities. *Diabetes Care* 22:832–843, 1999
3. Jacobson AM: The psychological care of patients with insulin-dependent diabetes mellitus. *N Engl J Med* 334: 1249–1253, 1996
4. Rubin RR, Peyrot M: Psychological problems and interventions in diabetes: a review of the literature. *Diabetes Care* 15: 1640–1657, 1992
5. Diabetes Epidemiology Research International Group: Secular trends in incidence of childhood IDDM in 10 countries. *Diabetes* 39:858–864, 1990
6. Karvonen M, Viik-Kajander M, Moltchanova E, Libman I, LaPorte R, Tuomilehto J, for the Diabetes Mondiale (DiaMond) Project Group: Incidence of childhood type 1 diabetes worldwide. *Diabetes Care* 23:1516–1526, 2000
7. Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P: Increased incidence of non-insulin-dependent diabetes mellitus among adolescents. *J Pediatr* 128:608–615, 1996
8. Jacobson AM, Hauser ST, Wertlieb D, Woldsdorf J, Orleans J, Viegra M: Psychological adjustment of children with recently diagnosed diabetes mellitus. *Diabetes Care* 9:323–329, 1986
9. Kovacs M, Feinberg TL, Paulauskas S, Finkelstein R, Pollock M, Crouse-Novak M: Initial coping responses and psychosocial characteristics of children with insulin-dependent diabetes mellitus. *J Pediatr* 106:827–834, 1985
10. Grey M, Cameron M, Lipman T, Thurber F: Psychosocial status of children with diabetes in the first 2 years after diagnosis. *Diabetes Care* 18:1330–1336, 1995
11. Jacobson AM, Hauser ST, Lavori P, Willett JB, Cole CF, Wolfsdorf JI, Dumont RH, Wertlieb D: Family environment and glycemic control: a four-year prospective study of children and adolescents with insulin-dependent diabetes mellitus. *Psychosom Med* 56:401–409, 1994
12. Kovacs M, Ho V, Pollock MH: Criterion and predictive validity of the diagnosis of adjustment disorder: a prospective study of youths with new-onset insulin-dependent diabetes mellitus. *Am J Psychiatry* 152:523–528, 1995
13. Kovacs M, Finkelstein R, Feinberg TL, Crouse-Novak M, Paulauskas S, Pollock M: Initial psychologic responses of parents to the diagnosis of insulin dependent diabetes mellitus in their children. *Diabetes Care* 8:568–575, 1985
14. Blanz B, Rensch-Riemann B, Fritz-Sigmund D, Schmidt M: IDDM is a risk factor for adolescent psychiatric disorders. *Diabetes Care* 16:1579–1587, 1993
15. Mayou R, Peveler R, Davies B, Mann J, Fairburn C: Psychiatric morbidity in young adults with insulin-dependent diabetes mellitus. *Psychol Med* 21:639–645, 1991
16. La Greca AM, Swales T, Klemp S, Madigan S, Skyler J: Adolescents with diabetes: Gender differences in psychosocial functioning and glycemic control. *Children's Health Care* 24:61–78, 1995
17. Kovacs M, Goldston D, Obrosky D, Bonnar L: Psychiatric disorders in youths with IDDM: rates and risk factors. *Diabetes Care* 20:36–44, 1997
18. Jacobson AM, Hauser ST, Willett J, Wolfsdorf JI, Herman L, de Groot M: Psychological adjustment to IDDM: 10-year follow-up of an onset cohort of child and adolescent patients. *Diabetes Care* 20:811–818, 1997
19. Wysocki T, Hough BS, Ward KM, Green LB: Diabetes mellitus in the transition to adulthood: adjustment, self-care, and health status. *J Dev Behav Pediatr* 13:194–201, 1992
20. Daneman D, Olmsted M, Rydall A, Maharaj S, Rodin G: Eating disorders in young women with type 1 diabetes: prevalence, problems and prevention. *Horm Res* 50 (Suppl. 1):79–86, 1998
21. Jones JM, Lawson ML, Daneman D, Olmsted MP, Rodin G: Eating disorders in adolescent females with and without type 1 diabetes: cross sectional study. *BMJ* 320:1563–1566, 2000
22. Rydall AC, Rodin GM, Olmsted MP, Devenyi RG, Daneman D: Disordered eating behavior and microvascular complications in young women with insulin-dependent diabetes mellitus. *N Engl J Med* 336:1849–1854, 1997
23. Holmes C, Richman L: Cognitive profiles of children with insulin-dependent diabetes. *J Dev Behav Pediatr* 6:323–326, 1985
24. Rovet J, Ehrlich R, Hoppe M: Specific intellectual deficits associated with the early onset of insulin-dependent diabetes mellitus in children. *Child Dev* 59: 226–234, 1988
25. Ryan C, Vega A, Drash A: Cognitive deficits in adolescents who developed diabetes early in life. *Pediatrics* 75:921–927, 1985
26. Ryan C, Longstreet C, Morrow L: The effects of diabetes mellitus on the school attendance and school achievement of adolescents. *Child Care Health Dev* 11: 229–240, 1985
27. Holmes C, Dunlap W, Chen R, Cornwell J: Gender differences in the learning status of diabetic children. *J Consult Clin Psychol* 60:698–704, 1992
28. Rovet J, Alvarez M: Attentional functioning in children and adolescents with IDDM. *Diabetes Care* 20:803–810, 1997
29. Kovacs M, Goldston D, Iyengar S: Intellectual development and academic performance of children with insulin-dependent diabetes mellitus: a longitudinal study. *Dev Psychol* 28:676–684, 1992
30. Kovacs M, Ryan C, Obrosky DS: Verbal intellectual and verbal memory performance of youths with childhood-onset insulin-dependent diabetes mellitus. *J Pediatr Psychol* 19:475–483, 1994
31. Northam E, Anderson P, Werther G, Warne G, Adler R, Andrewes D: Neuropsychological complications of IDDM in children 2 years after disease onset. *Diabetes Care* 21:379–384, 1998
32. Northam E, Anderson P, Werther G, Warne G, Andrewes D: Predictors of change in the neuropsychological profiles of children with type 1 diabetes 2 years after disease onset. *Diabetes Care* 22:1438–1444, 1999
33. Delamater AM: Quality of life in youths with diabetes. *Diabetes Spectrum* 13:42–46, 2000
34. Ingersoll GM, Marrero DG: A modified quality-of-life measure for youths: psychometric properties. *Diabetes Educator* 17:114–120, 1991
35. Grey M, Boland EA, Yu C, Sullivan-Bolyai S, Tamborlane WV: Personal and family factors associated with quality of life in adolescents with diabetes. *Diabetes Care* 21:909–914, 1998
36. Guttmann-Bauman I, Flaherty BP, Strugger M, McEvoy RC: Metabolic control and quality-of-life self-assessment in adolescents with IDDM. *Diabetes Care* 21:915–918, 1998
37. Jacobson AM, Hauser ST, Lavori P, Wolfsdorf J, Herskowitz R, Milley J, Bliss R, Gelfand E, Wertlieb D, Stein J: Adherence among children and adolescents with insulin-dependent diabetes mellitus over a four-year longitudinal follow-up: I. The influence of patient coping and adjustment. *J Pediatr Psychol* 15 511–526, 1990
38. Johnson SB, Kelly M, Henretta JC, Cunningham WR, Tomer A, Silverstein JH: A longitudinal analysis of adherence and health status in childhood diabetes. *J Pe-*

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- diatr Psychol* 17:537–553, 1992
39. Auslander WF, Thompson S, Dreitzer D, White NH, Santiago JV: Disparity in glycemic control and adherence between African-American and Caucasian youths with diabetes: family and community contexts. *Diabetes Care* 20:1569–1575, 1997
  40. Delamater AM, Albrecht DR, Postellon DC, Gutai JP: Racial differences in metabolic control of children and adolescents with type I diabetes mellitus. *Diabetes Care* 14:20–25, 1991
  41. Delamater AM, Shaw K, Applegate B, Pratt I, Eidson M, Lancelotta G, Gonzalez-Mendoza L, Richton S: Risk for metabolic control problems in minority youth with diabetes. *Diabetes Care* 22:700–705, 1999
  42. Miller-Johnson S, Emery R, Marvin R, Clarke W, Lovinger R, Martin M: Parent-child relationships and the management of insulin-dependent diabetes mellitus. *J Consult Clin Psychol* 62:603–610, 1994
  43. Schafer LC, Glasgow RE, McCaul KD, Dreher M: Adherence to IDDM regimens: relationship to psychosocial variables and metabolic control. *Diabetes Care* 6:493–498, 1983
  44. Anderson BJ, Miller JP, Auslander WF, Santiago JV: Family characteristics of diabetic adolescents: relationship to metabolic control. *Diabetes Care* 4:586–594, 1981
  45. Anderson BJ, Ho J, Brackett J, Finkelshtein D, Laffel L: Parental involvement in diabetes management tasks: relationships to blood glucose monitoring adherence and metabolic control in young adolescents with insulin-dependent diabetes mellitus. *J Pediatr* 130:257–265, 1997
  46. Hanson CL, Henggeler SW, Burghen GA: Model of associations between psychosocial variables and health-outcome measures of adolescents with IDDM. *Diabetes Care* 10:752–758, 1987
  47. Wysocki T: Associations among teen-parent relationships, metabolic control, and adjustment to diabetes in adolescents. *J Pediatr Psychol* 18:441–452, 1993
  48. Ingersoll GM, Orr D, Herrold A, Golden M: Cognitive maturity and self-management among adolescents with insulin-dependent diabetes mellitus. *J Pediatr* 108:620–623, 1986
  49. Wysocki T, Taylor A, Hough B, Linscheid T, Yeates K, Naglieri J: Deviation from developmentally appropriate self-care autonomy: association with diabetes outcomes. *Diabetes Care* 19:119–125, 1996
  50. Hanson CL, Cigrant JA, Harris M, Carle DL, Relyea G, Burghen GA: Coping styles in youths with insulin-dependent diabetes mellitus. *J Consult Clin Psychol* 57:644–651, 1989
  51. Delamater AM, Kurtz SM, Bubb J, White NH, Santiago JV: Stress and coping in relation to metabolic control of adolescents with type I diabetes. *J Dev Behav Pediatr* 8:136–140, 1987
  52. Grossman HY, Brink S, Hauser ST: Self-efficacy in adolescent girls and boys with insulin-dependent diabetes mellitus. *Diabetes Care* 10:324–329, 1987
  53. Kuttner MJ, Delamater AM, Santiago JV: Learned helplessness in diabetic youths. *J Pediatr Psychol* 15:581–594, 1990
  54. Brownlee-Duffeck M, Peterson L, Simonds JF, Goldstein D, Kilo C, Hoette S: The role of health beliefs in the regimen adherence and metabolic control of adolescents and adults with diabetes mellitus. *J Consult Clin Psychol* 55:139–144, 1987
  55. Charron-Parochownik D, Becker M, Brown M, Liang W, Bennett S: Understanding young children's health benefits and diabetes regimen adherence. *Diabetes Educator* 19:409–418, 1983
  56. Anderson BJ, Brackett J, Ho J, Laffel L: An office-based intervention to maintain parent-adolescent teamwork in diabetes management: impact on parent involvement, family conflict, and subsequent glycemic control. *Diabetes Care* 22:713–721, 1999
  57. Satin W, La Greca A, Zigo M, Skyler J: Diabetes in adolescence: effects of multifamily group intervention and parent simulation of diabetes. *J Pediatr Psychol* 14:259–276, 1989
  58. Wysocki T, Harris M, Greco P, Bubb J, Danda C, Harvey L, McDonnell K, Taylor A, White N: Randomized, controlled trial of behavior therapy for families of adolescents with insulin-dependent diabetes mellitus. *J Pediatr Psychol* 25:23–34, 2000
  59. Delamater AM, Bubb J, Davis S, Smith J, Schmidt L, White N, Santiago JV: Randomized, prospective study of self-management training with newly diagnosed diabetic children. *Diabetes Care* 13:492–498, 1990
  60. Anderson BJ, Wolf F, Burkhart M, Cornell R, Bacon G: Effects of peer-group intervention on metabolic control of adolescents with IDDM: randomized outpatient study. *Diabetes Care* 12:179–183, 1989
  61. Kaplan R, Chadwick M, Schimmel L: Social learning intervention to promote metabolic control in type I diabetes mellitus: pilot experimental results. *Diabetes Care* 8:152–155, 1985
  62. Boland EA, Grey M, Oesterle A, Fredrickson L, Tamborlane WV: Continuous subcutaneous insulin infusion: a new way to lower risk of severe hypoglycemia, improve metabolic control, and enhance coping in adolescents with type I diabetes. *Diabetes Care* 22:1779–1784, 1999
  63. Grey M, Boland EA, Davidson M, Yu C, Sullivan-Bolyai S, Tamborlane WV: Short-term effects of coping skills training as adjunct to intensive therapy in adolescents. *Diabetes Care* 21:902–908, 1998
  64. Boardway RH, Delamater AM, Tomakowsky J, Gutai JP: Stress management training for adolescents with diabetes. *J Pediatr Psychol* 18:29–45, 1993
  65. Mendez F, Belendez M: Effects of a behavioral intervention on treatment adherence and stress management in adolescents with IDDM. *Diabetes Care* 20:1370–1375, 1997
  66. Davis WK, Hess GE, Hiss RG: Psychosocial correlates of survival in diabetes. *Diabetes Care* 11:538–545, 1988
  67. Gavard JA, Lustman PJ, Clouse RE: Prevalence of depression in adults with diabetes: an epidemiological evaluation. *Diabetes Care* 16:1167–1178, 1993
  68. Peyrot M, Rubin RR: Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 20:585–590, 1997
  69. Lustman PJ, Griffith L, Clouse R, Cryer P: Psychiatric illness in diabetes mellitus: relationship to symptoms and glucose control. *J Nerv Ment Dis* 174:736–742, 1986
  70. Lustman PJ, Griffith L, Gavard JA, Clouse RE: Depression in adults with diabetes. *Diabetes Care* 15:1631–1639, 1992
  71. Jacobson AM, de Groot M, Samson JA: The effects of psychiatric disorders and symptoms on quality of life in patients with type I and type II diabetes mellitus. *Qual Life Res* 6:11–20, 1997
  72. Peyrot M, Rubin RR: Persistence of depressive symptoms in diabetic adults. *Diabetes Care* 22:448–452, 1999
  73. Lustman PJ, Anderson R, Freedland K, De Groot M, Carney R, Clouse R: Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care* 23:934–942, 2000
  74. Eaton W, Armenian H, Gallo J, Pratt L, Ford D: Depression and risk for onset of type II diabetes: a prospective, population-based study. *Diabetes Care* 19:1097–1102, 1996
  75. Kawakami N, Takatsuka N, Shimizu H, Ishibashi H: Depressive symptoms and occurrence of type 2 diabetes among Japanese men. *Diabetes Care* 22:1071–1076, 1999
  76. Forrest K, Becker D, Kuller L, Wolfson S, Orchard T: Are predictors of coronary heart disease and lower-extremity arterial disease in type 1 diabetes the same?

- A prospective study. *Atherosclerosis* 148: 159–169, 2000
77. Lustman PJ: Anxiety disorders in adults with diabetes mellitus. *Psychiatr Clin North Am* 11:419–432, 1988
  78. Lustman PJ, Griffith L, Freedland K, Kissel S, Clouse R: Cognitive behavior therapy for depression in type 2 diabetes: a randomized controlled trial. *Ann Intern Med* 129:613–621, 1998
  79. Lustman PJ, Freedland K, Griffith L, Clouse R: Effects of fluoxetine on depression and glycemic control in diabetes: a double-blind, placebo-controlled trial (Abstract). *Ann Behav Med* 21:S158, 1999
  80. Lustman PJ, Griffith LS, Clouse RE, Freedland KE, Eisen SA, Rubin EH, Carney RM, McGill JB: Effects of alprazolam on glucose regulation in diabetes: results of a double-blind, placebo-controlled trial. *Diabetes Care* 18:1133–1139, 1995
  81. Rodin F, Daneman D: Eating disorders and IDDM. *Diabetes Care* 15:1402–1412, 1992
  82. Affentio SG, Backstrand JR, Welch GW, Lammi-Keefe CF, Rodriguez NR, Adams CH: Subclinical and clinical eating disorders in IDDM negatively affect metabolic control. *Diabetes Care* 20:182–184, 1997
  83. Glasgow RE, Toobert DJ: Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11:377–386, 1988
  84. Peyrot M, McMurry JF, Kruger DF: A biopsychosocial model of glycemic control in diabetes: stress, coping, and regimen adherence. *J Health Soc Behav* 40: 141–158, 1999
  85. Gonder-Frederick L, Carter W, Cox DJ, Clarke W: Environmental stress and blood glucose change in insulin-dependent diabetes mellitus. *Health Psychol* 9:503–515, 1990
  86. Halford WK, Cuddihy S, Mortimer RH: Psychological stress and blood glucose regulation in type I diabetic patients. *Health Psychol* 9:516–528, 1990
  87. Griffith LS, Field BJ, Lustman PJ: Life stress and social support in diabetes: association with glycemic control. *Int J Psychiatr Med* 20:365–372, 1990
  88. Surwit R, Feinglos M, Livingston E, Kuhn C, McCubbin J: Behavioral manipulation of the diabetic phenotype in ob/ob mice. *Diabetes* 33:616–618, 1984
  89. Surwit R, McCubbin J, Livingston E, Feinglos M: Classically conditioned hyperglycemia in the obese mouse. *Psychosom Med* 47:565–568, 1985
  90. Surwit R, McCubbin J, Kuhn C, McGee D, Gerstenfeld D, Feinglos M: Alprazolam reduces stress hyperglycemia in ob/ob mice. *Psychosom Med* 48:278–282, 1986
  91. Mooy JM, de Vries H, Grootenhuys PA, Bouter LM, Heine RJ: Major stressful life events in relation to prevalence of undetected type 2 diabetes: the Hoorn Study. *Diabetes Care* 23:197–201, 2000
  92. Langan S, Deary I, Hepburn D, Frier B: Cumulative cognitive impairment following recurrent severe hypoglycaemia in adult patients with insulin-treated diabetes. *Diabetologia* 34:333–343, 1991
  93. Ryan C, Williams T, Orchard T, Finegold D: Psychomotor slowing is associated with distal symmetrical polyneuropathy in adults with diabetes mellitus. *Diabetes* 41:107–113, 1992
  94. Reaven G, Thompson L, Nahum D, Haskins E: Relationship between hyperglycemia and cognitive function in older NIDDM patients. *Diabetes Care* 13:16–21, 1990
  95. Bott U, Muhlhauser I, Overmann H, Berger M: Validation of a diabetes-specific quality-of-life scale for patients with type 1 diabetes. *Diabetes Care* 21:757–769, 1998
  96. Polonsky W: Understanding and assessing diabetes-specific quality of life. *Diabetes Spectrum* 13:36–41, 2000
  97. Rubin RR, Peyrot M: Quality of life and diabetes. *Diabetes Metab Res Rev* 15:205–218, 1999
  98. Glasgow RE, Ruggiero L, Eakin EG, Dryfoos J, Chobanian L: Quality of life and associated characteristics in a large national sample of adults with diabetes. *Diabetes Care* 20:562–567, 1997
  99. Chantelau E, Schiffrers T, Schutze J, Hansen B: Effect of patient-selected intensive insulin therapy on quality of life. *Patient Educ Counseling* 30:167–173, 1997
  100. Aalto AM, Uutela A, Aro AR: Health related quality of life among insulin-dependent diabetics: disease-related and psychosocial correlates. *Patient Educ Counseling* 30:215–225, 1997
  101. Watkins KW, Connell CM, Fitzgerald JT, Klem L, Hickey T, Ingersoll-Dayton B: Effect of adults' self-regulation of diabetes on quality-of-life outcomes. *Diabetes Care* 23:1511–1515, 2000
  102. Anderson RM, Fitzgerald JT, Wisom K, Davis W, Hiss R: A comparison of global versus disease-specific quality-of-life measures in patients with NIDDM. *Diabetes Care* 20:299–305, 1997
  103. Jacobson AM, de Groot M, Samson JA: The evaluation of two measures of quality of life in patients with type I and type II diabetes. *Diabetes Care* 17:267–274, 1994
  104. Clement S: Diabetes self-management education. *Diabetes Care* 18:1204–1214, 1995
  105. Anderson RM, Funnell M, Butler P, Arnold M, Fitzgerald J, Feste C: Patient empowerment: results of a randomized controlled trial. *Diabetes Care* 18:943–949, 1995
  106. Pieber TR, Brunner GA, Schnedl WJ, Schattenberg S, Kaufmann P, Krejs GJ: Evaluation of a structured outpatient group education program for intensive insulin therapy. *Diabetes Care* 18:625–630, 1995
  107. Rubin RR, Peyrot M, Saudek C: Effect of diabetes education on self-care, metabolic control, and emotional well-being. *Diabetes Care* 12:673–679, 1989
  108. Rubin RR, Peyrot M, Saudek C: The effect of a diabetes education program incorporating coping skills training on emotional well-being and diabetes self-efficacy. *Diabetes Educator* 19:210–214, 1993
  109. Anderson RM, Herman WH, Davis JM, Friedman RP, Funnell MM, Neighbors HW: Barriers to improving diabetes care for black persons. *Diabetes Care* 14:605–609, 1991
  110. Glasgow RE, Toobert DJ, Hampson S, Brown J, Lewinson P, Donnelly J: Improving self-care among older patients with type II diabetes: the "Sixty Something. . ." study. *Patient Educ Counsel* 19:61–74, 1992
  111. Cox DJ, Gonder-Frederick L, Polonsky W, Schlundt D, Julian D, Clarke W: A multicenter evaluation of blood glucose awareness training-II. *Diabetes Care* 18: 523–528, 1995