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Developmental Differences in Primary and Secondary Control Coping and Adjustment to Juvenile Diabetes

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Compared diabetic youngsters at two levels of cognitive maturity to explore developmental differences in relations between child characteristics and adjustment. Differences in coping style and in pattern of relationships emerged between formal operational and pre-formal groups. For example, knowledge about diabetes was positively related to medical adjustment for the formal but not the pre-formal children. Although all child characteristics were related to one or more adjustment measures, no relationship between a child variable and an adjustment measure replicated across the two cognitive level groups. The findings suggest that a developmental perspective may help refine our understanding of children's adaptation to chronic illness.

Insulin-dependent diabetes mellitus is one of the most common chronic diseases of childhood, affecting approximately 150,000 children nationally (Cerreto & Travis, 1984). Unlike most chronic childhood disorders, diabetes presents opportunities for the patient to exert control over the disease via a daily regimen of insulin administration, blood glucose monitoring, diet, and exercise. Of course, diabetic children differ in their success at such medical management, and in their social and behavioral adjustment as well. Yet we know surprisingly little about which child characteristics may be associated with good medical, social, or behavioral adjustment in diabetic youngsters. Despite research focused on such child factors as knowledge about diabetes (e.g., Eiser, Patterson, & Town, 1985; Garner & Thompson, 1974; Johnson et al., 1982), perceived control and efficacy (Moffat & Pless, 1983; Tennen, Affleck, Allen, McGrade, & Ratzan, 1984), and coping approaches (e.g., Koski, 1969), few unambiguous findings have emerged.

One possible reason is that few studies have followed a developmental approach, probing for age differences in (a) potentially relevant child characteristics, and (b) relations between such characteristics and diabetes adjustment. Recent research underscores the need for developmental sensitivity. Findings suggest that children at different developmental levels may differ in (a) their capacity to acquire disease knowledge (Johnson et al., 1982), (b) their reasoning about personal control and efficacy (Weisz, 1986), and (c) their styles of coping with stress (Band & Weisz, 1988). Such developmental differences might well apply to diabetic youngsters as well as healthy ones. Moreover, it seems quite possible that factors such as these might correlate with adjustment to diabetes at some developmental levels but not others (see rationale discussed later). Here we explored both possibilities.

Because our interest was in cognitive developmental differences, not simply age, we distinguished between diabetic youngsters at two cognitive levels in Piaget's (1970) developmental framework: formal operational youngsters (capable of abstract thought and hypothetico-deductive reasoning) and youngsters who had not yet attained formal operations. We compared these two groups in two ways. First, we tested for group differences on the four child characteristics noted earlier, as applied to diabetes: diabetes-related knowledge, coping style, perceived control, and perceived coping efficacy. Next, we tested whether the groups differed in relations between these child variables and multiple measures of diabetes adjustment. In what follows, we describe the four child response variables and the five adjustment measures.

Because diabetes demands great responsibility for self-care, disease knowledge has been assumed to be important to successful diabetes management. Prior research (Collier & Etzweiler, 1971; Eiser et al., 1985; Garner & Thompson, 1974; Johnson et al., 1982) has probed the accuracy of children's diabetes knowledge and relations between knowledge and diabetes adjustment (e.g., performance of self-care

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tasks). Results concerning relations between children's knowledge and adjustment have been quite mixed. In an attempt to clarify the picture, we tested not only whether diabetes knowledge would be greater among formal than preformal children, but also whether relations between knowledge and diabetes adjustment might vary with cognitive level. This seemed possible, because less mature children would be likely to receive closer adult supervision in managing their diabetes than would more mature children; thus, adjustment might depend more on diabetes knowledge among more mature than among less mature children. Like disease knowledge, children's coping styles have also been thought to contribute to their disease self-management and adjustment. Although conceptualizations of coping often vary, most work in this realm has construed "coping" as compliance with the diabetes regimen. Our view of coping is somewhat broader and is based on a "two-process" model of perceived control (Rothbaum, Weisz, & Snyder, 1982; Weisz, Rothbaum, & Blackburn, 1984a, 1984b). The model distinguishes between two general coping approaches—coping aimed at influencing objective conditions or events (primary control) and coping aimed at influencing the personal psychological impact of objective conditions or events as they are (secondary control). Primary coping would seem integral to active efforts to change circumstances that are modifiable (e.g., consistent administration of insulin to regulate blood sugar levels), whereas secondary coping may be vital to psychological adaptation to unalterable circumstances (e.g., accepting the fact that diabetes is a lifelong condition). Recent findings with a general population sample of 6 to 12-year-olds (Band & Weisz, 1988) indicate that the ratio of secondary to primary coping in response to everyday stressors may increase with age. Here we tested whether formal and pre-formal diabetic children might differ in their use of primary and secondary coping in response to diabetes-related stressors (Band, 1990) and whether coping style might be differentially related to diabetes adjustment at the two cognitive levels.

We also focused on children's perceptions of control and efficacy. Perceptions of control have been linked to individual differences in the extent to which people learn about, or take responsibility for, their medical condition (Strickland, 1978). Similarly, efficacy expectancies are thought to affect the level of effort individuals will expend to respond to challenging circumstances (Bandura, 1977). Delamater (1986) argued that the role of such child cognitive appraisals in adjustment to diabetes is an essential issue for study, and others have proposed specific linkages between control and children's diabetes adjustment (Moffat & Pless, 1983), and between perceptions of efficacy and regimen adherence (Sanders, Mills, Martin, & Horne, 1975). By contrast, Folkman (1984) noted that appraisals of uncontrollability do not invariably lead to negative outcomes, and, indeed, some research has indicated that diabetics' perceived control over health outcomes is unrelated to their coping and metabolic control (Tennen et al., 1984). Here we explored whether the relationships between adjustment, on the one hand, and perceived control and efficacy, on the other, might be clarified via a developmental approach; it seemed possible, for example, that perceptions of control and efficacy might have a different impact on adjustment among formal operational children, who can link such abstract cognitions to action in the form of disease management, than among pre-formal youngsters, for whom such linkage would appear less likely.

We used multiple measures of diabetes adjustment, reflecting the approaches most commonly represented in the literature. One approach has construed adjustment as proper medical maintenance, often measured by indicators of the child's blood glucose/metabolic control (Delamater, 1986); we included a physician-report measure of this type. Another approach has been to assess children's behavioral (e.g., checks blood sugar daily) and social (e.g., avoids overactive play with peers) adjustment via self- or parent-report (e.g., Johnson, 1984); we included such a parent-report measure. A third approach has been to rely on general measures of child problem behavior or family functioning (e.g., Kurtz & Delamater, 1984; Orr, Golden, Meyers, & Marrero, 1983); in keeping with this approach, we used a standard problem-report checklist.

Method

Subjects and Experimental Design

The sample consisted of 64 children being treated for diabetes at three hospitals. To control for the "honeymoon" phase of relatively easy metabolic control often following disease onset, children diagnosed within the preceding 12 months were excluded from the sample. Two groups were included: 32 children (13 girls, 19 boys) averaging 8.8 years of age ($SD = 2.4$ years) composed the pre-formal operational group, and 32 children (18 girls, 14 boys) averaging 14.6 years of age ($SD = 1.9$ years) composed the formal operational group.

The two groups were formed using a Piagetian task (from Lunzer, 1968) shown to differentiate formal operational from pre-formal children. The task first uses a toy farmer and field to assess children's understanding of conservation of area ("How much land does the farmer have if we change the shape of his field—more, less, or the same?"). Next, the task assesses false conservation of perimeter ("When the farmer walks all the way around his new field, how far does he go—more distance, less, or the same?"); formal operational children, unlike pre-formal children, recognize that, when the field changes shape, area is conserved but perimeter is not. Children who answered area and perimeter questions correctly and gave conceptually accurate explanations for their answers were classified as formal operational; the remaining children were classified as pre-formal.

Child Measures

Each child's diabetes-related coping approaches, perceptions of control, perceptions of coping efficacy, and diabetes knowledge were assessed via a structured interview, conducted individually during a regularly scheduled clinic visit. The interview addressed five specific stresses of diabetes and its treatment (diet, insulin injections, insulin reactions, daily glucose monitoring, and hemoglobin A-1 tests) and three broader concerns ("having diabetes"—in general; "staying well"; and "staying happy" with diabetes). The specific stresses were suggested by prior literature (see Eiser et al., 1985; Galazter, Frish, & Laron, 1977). For each stress, children were asked to rate perceived control, to describe the coping approaches they use, and to rate the efficacy of their coping efforts.

Perceived control. To assess perceived control, we asked children to rate "How much you can help yourself and make things better?" on a 5-point Likert-type scale ranging from *not at all* (1) to *really a lot* (5).

Coping style. To assess coping approaches, children related up to three things they think or do to help themselves and then explained how each strategy "helps or makes things better" (coding system to be discussed later).

Perceived coping efficacy. To assess perceived coping efficacy, children rated how much each coping strategy reported would help them on a 5-point Likert-type scale ranging from *It will only help a little bit* (1) to *It will really help a lot* (5).

Diabetes knowledge. To assess diabetes knowledge, children were asked two types of questions, patterned after Johnson et al. (1982): A series of open-ended queries probed factual disease understanding (e.g., "Why do you need to take insulin?"), and multiple-choice questions assessed practical knowledge (e.g., "What should you do if you feel dizzy?").

Coding for Style of Coping

Children's descriptions of coping were coded along the dimensions of the primary–secondary control model (Rothbaum et al., 1982). Primary control involves efforts to modify or change objective circumstances directly, and secondary control involves efforts to modify or influence the impact of objective circumstances on one's subjective psychological state (e.g., by adjusting one's affect, expectations, or mood, so as to achieve a goodness of fit with circumstances as they are). For example, a child might report attempting to cope by "taking insulin to control my sugar" (primary control) or by "telling myself I can still live a full life" (secondary control). Each coping strategy described was rated on a 5-point scale to reflect the relative degree of *primary* (1) to *secondary* (5) coping. We also coded a third category, *relinquished control,* the absence of goal-directed activity or coping (e.g., "giving up" or "doing nothing"). Interrater reliability for the primary–secondary coding was assessed by having two raters independently judge 37 responses from three randomly selected children; the pairwise kappa was .95.

For analyses reported later, individual strategy ratings were averaged across the various stresses to yield a single score reflecting average primary–secondary coping style for each child. Strategies fitting the relinquished control category turned out to be so rare (i.e., only 5 of the 809 responses) that this category was dropped.

Adjustment Measures

Physician ratings: Medical Adjustment Scale (MAS). To rate medical adjustment, each child's physician or nurse practitioner completed the MAS for the child. The MAS involved Likert-type ratings (1 = *poor,* 5 = *excellent*) on five dimensions: hemoglobin A-1 blood test results ranging from > 12% (poor) to 9% (excellent), daily blood glucose records, adherence to diet, attitude and cooperativeness regarding diabetes care tasks, and ease of managing the child's illness. All ratings were summed, forming the total MAS score, which ranged from 5 (poorest adjustment) to 25 (most favorable adjustment).

Parent ratings: Socio-Behavioral Adjustment Scale (SBAS) and Conners Parent Questionnaire (CPQ). Parents completed two measures of child adjustment, one specifically probing social and behavioral adaptation to diabetes (SBAS), the other assessing more global psychosocial adjustment (CPQ). The SBAS was a seven-item checklist addressing behavioral adjustment (child performance of specific self-care behaviors—e.g., adherence to diet, blood sugar monitoring) and psychosocial adjustment specifically related to diabetes (e.g., complaining about being different from other kids, avoiding physical activities). Parents indicated whether each item described their child, using a *yes–no* response format. Responses were summed to yield an index of sociobehavioral diabetes adjustment.

The second measure was the CPQ (Goyette, Conners, & Ulrich, 1978). This 48-item problem checklist has been factor-analyzed to yield several scales; we used three: Conduct Problems (e.g., lying, fighting), Psychosomatic Problems (e.g., headaches, stomachaches), and Anxiety. Deviation scores for these CPQ scales were obtained for each child based on norms for the child's age and sex group.

Reliability Assessment

Because all measures other than the CPQ were based on the combination of individual scores, scaling procedures were employed to assess reliability of the global scores. A Likert scale reliability analysis (SPSS Inc., 1983) was performed on the individual items comprising each measure. These analyses yielded the following reliability estimates via Cronbach's alpha coefficients: .76 (perceived control), .75 (primary–secondary coping style), .70 (perceived efficacy), .79 (diabetes knowledge), .92 (MAS), and .42 (SBAS). The modest SBAS coefficient can be understood to reflect the more diverse nature of the items composing this measure (i.e., both behavioral and social functioning) as well as the use of dichotomous, rather than multilevel scaling. Subsequent research may help to define further the constructs underlying the SBAS, and their relations with other child measures.

Relations Among Adjustment Measures and Child Measures

We calculated Pearson correlations among the adjustment measures and the child measures. Among the adjustment measures, MAS and SBAS scores were correlated .25 ($p < .05$), suggesting that children with more favorable medical adjustment ratings from medical staff also had slightly more favorable sociobehavioral ratings from their parents. SBAS and CPQ conduct problem ratings were correlated $-.60$ ($p < .001$), indicating that children rated high in conduct problems received less favorable SBAS ratings from their parents. Among the child measures, perceived control and perceived coping efficacy were correlated .72 ($p < .0001$), suggesting that children with greater perceived control also perceived their coping to be more efficacious. Diabetes knowledge and primary–secondary coping style were correlated .62 ($p < .001$), indicating that children with greater disease knowledge had more secondary styles of coping. (This seems reasonable, because both diabetes knowledge and secondary coping appear to increase with cognitive maturity.) No other correlations were significant. Tests of normality indicated no substantial departure from a normal distribution for any of the measures.

Results

Analyses began with tests of mean differences between the formal and pre-formal groups on the four child response measures and the five adjustment measures. (The three CPQ scores were expected to show no significant group differences; they were deviation scores adjusted for age group norms.) Next, preplanned correlational analyses probed relations between the child variables and each adjustment measure.

Cognitive Level Group Differences

We conducted t tests on each variable to assess mean differences between the formal and pre-formal groups (see Table 1). As expected, the three CPQ deviation scores did not show significant group differences. Three of the six remaining tests were significant. Compared to the pre-formal group, formal operational youngsters showed more advanced levels of diabetes knowledge, $t(62) = 8.95, p < .0001$, and used more secondary control coping approaches, $t(62) = 9.38, p < .0001$; but medical staff ratings of the children's medical adjustment (on the MAS) were actually higher for the pre-formal than the formal group, $t(60) = 2.88, p < .005$.

Correlates of Diabetes Adjustment in Formal and Pre-Formal Groups

We analyzed correlates of adjustment, as indexed by the MAS, the SBAS, and the three CPQ measures. For each adjustment measure, we calculated Pearson correlations separately for each cognitive developmental group ($n = 32$) to probe whether relationships were qualified by level of cognitive maturity. As is seen later, every significant relationship was thus qualified. Results for each cognitive developmental group are summarized in Table 2. The overall matrix was tested and found to be significant ($p < .05$). However, to provide further protection against chance findings resulting from multiple comparisons, we used binomial distribution tables to determine the number of statistically significant findings likely to arise by chance and treated the lowest significant values up to that number as nonsignifi-

Table 1. *Mean Comparisons for Formal Operational and Pre-Formal Groups on Child Response Variables and Diabetes Adaptation Measures*

Dependent Measure	Group		*SD*	*t*	*df*
	Pre-Formal	Formal			
Child Response Variable					
Primary–Secondary Coping	1.53	2.59	.70	9.38**	62
Perceived Control	4.07	4.08	.54	.07	62
Coping Efficacy	4.38	4.51	.37	1.36	62
Diabetes Knowledge	4.31	8.44	2.76	8.95**	62
Diabetes Adjustment Measure					
MAS	18.0	14.0	5.68	2.88*	
SBAS	5.84	6.19	1.57	.88	
CPQ Anxiety	.25	.23	.66	.14	
CPQ Psychosomatic Problems	1.44	1.32	1.44	.31	
CPQ Conduct Problems	.47	.58	1.06	.41	

Notes: Primary–secondary scale ranges from *primary control coping* (1) to *secondary control coping* (5); all CPQ scores are deviation scores based on age group norms—thus, developmental group differences should not be found on any of the three CPQ scores.
$^{*}p < .005$. $^{**}p < .0001$.

cant (see Field & Armenakis, 1974). In Table 2, we note (superscript *b*) findings that met conventional standards for significance but fell below these additional standards.

Correlates of Medical Adjustment (MAS). Correlations between child response variables and staff ratings of children's medical adjustment revealed that MAS scores were significantly related to diabetes knowledge, but only in the formal operational group ($r = .45$).

Correlates of Sociobehavioral Adjustment (SBAS). Correlations between child variables and parent ratings of children's sociobehavioral adjustment to diabetes revealed several relationships, all

Table 2. *Correlations Between Child Self-Report Variables and Measures of Child Adjustment*

Rating of Child Adjustment	Child Adjustment Measure			
	Primary–Secondary Coping[a]	Perceived Control	Coping Efficacy	Diabetes Knowledge
Physician Ratings of Medical Adjustment (MAS)				
Pre-Formal Operations	.16	−.03	−.13	.10
Formal Operations	−.32[b]*	.12	.11	.45**
Parent Ratings of SocioBehavioral Adjustment (SBAS)				
Pre-Formal Operations	.25	.06	−.17	.30
Formal Operations	−.39**	.41**	.57***	.19
Parent Ratings of Global Behavior Problems (CPQ)				
Anxiety				
Pre-Formal Operations	−.21	−.16	.01	−.23
Formal Operations	−.05	.03	.02	−.02
Psychosomatic Problems				
Pre-Formal Operations	.28	−.57***	−.37[b]*	.25
Formal Operations	−.07	−.02	.13	.08
Conduct Problems				
Pre-Formal Operations	−.28	.15	.16	.00
Formal Operations	.33[b]*	−.36[b]*	−.42**	−.10

[a]Primary–secondary scale ranges from *primary control coping* (1) to *secondary control coping* (5). [b]Denotes *p* values that were not significant following Bonferroni correction.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

qualified by cognitive level. First, we found a significant negative relation between SBAS and primary–secondary coping, but only for the formal group ($r = .25$). More primary styles of coping were associated with more favorable SBAS ratings in the formal group.

Neither perceived control nor perceived coping efficacy was significantly correlated with SBAS ratings in the pre-formal group, but both measures were correlated with SBAS in the formal operational group (control $r = .41$, efficacy $r = .57$). Formal operational youngsters receiving more favorable sociobehavioral adjustment ratings tended to exhibit greater perceived control over their diabetes and greater perceived coping efficacy.

Correlates of global behavior problem scores (CPQ). Analyses of relations between child variables and CPQ problem ratings yielded two significant associations. For pre-formal children only, a negative correlation ($r = -.57$) emerged between child ratings of perceived control and CPQ psychosomatic problem scores. This indicated that pre-formal children with fewer psychosomatic difficulties tended to have greater perceived control over their diabetes.

An additional finding concerned CPQ conduct problem scores. These scores were significantly related to perceived coping efficacy within the formal group ($r = -.42$). Formal operational youngsters with more conduct problems rated themselves lower in coping effectiveness.

Multiple-Regression Analyses

Finally, we performed stepwise multiple-regression analyses, to probe which variables best predicted adjustment from among those that were significantly correlated with the adjustment measures. For these four analyses, we included all predictors that met conventional standards of statistical significance in Table 2. First, we examined predictors for the pre-formal children, probing perceived control and coping efficacy as predictors of psychosomatic problems. The analysis revealed perceived control as the best predictor, $F(1, 30) = 14.20$, $p < .001$, yielding $R^2 = .32$, with no significant increment in variance accounted for by inclusion of coping efficacy in the model.

Next, we examined predictors for the formal-operational children. First we tested primary–secondary coping style and diabetes knowledge as predictors of medical adjustment. This analysis indicated that knowledge was the best predictor of medical adjustment, $F(1, 30) = 7.81$, $p < .01$, with coping style accounting for additional variance at the .15 level, such that $R^2 = .27$ with both predictors in the model. Next, we tested primary–secondary coping, perceived control, and coping efficacy as predictors of sociobehavioral adjustment for the formal operational youngsters. This analysis indicated perceived coping efficacy, $F(1, 30) = 15.13$, $p < .001$, and primary–secondary coping style, $F(1, 30) = 5.26$, $p < .05$, as the only significant predictors for sociobehavioral adjustment ($R^2 = .44$ with both predictors included). Finally, we probed primary–secondary coping, perceived control, and coping efficacy as predictors of conduct problems among the formal-operational children. Perceived coping efficacy was the best predictor, $F(1, 30) = 6.12$, $p < 01$, with coping style accounting for additional variance at the .15 level, ($R^2 = .25$ with both predictors in the model).

Discussion

The findings suggest that a developmental perspective may be essential for an accurate understanding of children's adaptation to such chronic illnesses as diabetes. Here youngsters at two different cognitive-developmental levels were found to differ markedly in theoretically important ways. First, formal-operational and pre-formal groups differed in coping approaches, factual knowledge about their illness, and medical adjustment as rated by medical staff. Second, the two groups differed markedly with regard to which child factors correlated with diabetes adjustment. Among the child factors examined here—coping style, perceived control, perceived coping efficacy, and diabetes knowledge—very different patterns of relations emerged for formal and pre-formal youngsters. Indeed, the differences were so striking that, in no instance, was any significant relationship between a child variable and an adjustment measure replicated across the two cognitive level groups.

For pre-formal children, perceived control emerged as the best predictor of adjustment, specifically of psychosomatic problems. It is not surprising that somatic problems should be negatively associated with perceived control over diabetes among pre-formal children, for whom concrete bodily problems (e.g., headaches, stomachaches) may be a particularly salient indicator of lack of personal control. Such readily identifiable somatic problems may well lead young children to conclude that their diabetes self-care activities (insulin injections, fingersticks, etc.) are ineffective, and thus diminish their sense of control over the disorder. Significantly, perceived control was the only variable related to adjustment for the pre-formal children.

In contrast, primary–secondary coping style, perceived coping efficacy, and diabetes knowledge were each significantly associated with adjustment for the formal operational youngsters. For medical adjustment, diabetes knowledge was the best predictor: Greater knowledge was associated with more favorable medical adjustment. These results may help clarify a puzzling earlier finding by Hamburg and Inoff (1982) indicating that, with age statistically controlled, diabetes knowledge was negatively related to diabetes control. Our findings suggest that the impact of disease knowledge may differ with development and that knowledge acquisition may be increasingly important with greater cognitive maturity. This seems plausible in light of the fact that more mature youngsters are apt to play a more direct and independent role in medical management of their disorder than less mature children, whose parents may supervise their medical management more directly and actively, thus reducing the relevance of what these children know about diabetes. Data cited by Ingersoll, Orr, Herrold, and Golden (1986) are consistent with this reasoning. They suggested that parental withdrawal from medical management of teenage diabetics is not always balanced by the adolescent's assumption of responsibility and that less cognitively mature adolescents may be given responsibility for self-care that they are unable to assume.

Although knowledge was related to general medical adjustment in the formal group, primary–secondary coping style significantly predicted both medical adjustment and sociobehavioral adjustment. This is consistent with recent findings suggesting that diabetic adolescents' styles of coping relate to their diabetic control (Delamater, Kurtz, Bubb, White, & Santiago, 1987). However, the direction of the predictive relationships found here may be surprising to some readers: More primary (vs. secondary) styles of coping were associated with more favorable medical and sociobehavioral adjustment. The salience of primary coping, in particular, is understandable given the emphasis that parents and medical personnel are likely to place on primary-type strategies, which often involve vital self-care behavior. Primary control strategies directed at modifying immediate physiological states (e.g., "taking insulin to lower my blood sugar") were prevalent in the youngsters' self-reports of coping. By contrast, formal-operational children described two subsets of secondary-type strategies. One set appeared likely to contribute to adjustment (e.g., "keeping a positive attitude"; "feeling good about taking proper care of myself"), whereas others appeared less adaptive (e.g., "I tell myself I don't care about any of it"; "I say it doesn't matter"). It is possible that secondary strategies of this latter sort may undermine utilization of essential primary coping activities and thus contribute to the linkage between primary coping and adjustment among formal-operational children.

Whereas our data suggest a linkage between primary coping and favorable diabetes adjustment for formal operational youngsters, Marrero, Golden, Kershnar, and Myers (1982) found that poorly controlled adolescents actually used a greater number of instrumental coping strategies than did well-controlled patients. Although this finding emerged using similar coping constructs (problem- vs. emotion-focused coping), it would seem to underscore that instrumental or primary coping may not be sufficient, alone, to ensure adaptive outcomes, despite the basic necessity of instrumental behavior to diabetic control.

Parent ratings of sociobehavioral adjustment were positively correlated with perceived control and coping efficacy, but again, only among formal-operational children. This is consistent with the notion that, as youngsters move into formal operations, their bases for self-assessment become increasingly adult-like and thus increasingly similar to those of their parents (cf. Harter, 1983; Nicholls & Miller, 1984; Weisz, 1986). Accordingly, it might be expected that formal-operational youngsters' self-ratings of their own efficacy in coping with diabetes and their own control over their disorder would be positively correlated with the diabetes adjustment ratings made by their parents. By contrast, our findings with pre-formal youngsters suggest that their perceptions of control (significantly) and coping efficacy (marginally) are most strongly linked to such concrete indicators as somatic problems (indexed by the CPQ).

Finally, perceived coping efficacy was negatively correlated with conduct problems among the formal operational children. This linkage between conduct problems and low perceived efficacy raises the possibility that external behavior difficulties among formal-operational youngsters may, in part, mask underlying feelings of helplessness or inefficacy, especially vis-à-vis disease-related demands (cf. Weiss & Weisz, 1988). More cognitively mature youngsters may be especially vulnerable to feeling ineffective as they acquire more realistic understanding of their disease. They may come to recognize, for example, that there are significant limits to their capacity for control (e.g., that, no matter what they do, their diabetes is a lifelong disorder and that symptom control may fluctuate despite their best efforts at self-care).

All three of our findings on mean differences between the cognitive groups suggest that our data are in line with previous findings. This is certainly true of our findings indicating that diabetes knowledge is more extensive, and secondary control coping more likely, in more mature youngsters than in less mature children (see, e.g., Band, 1990; Band & Weisz, 1988). It is even true of our finding that less cognitively mature youngsters had higher ratings of medical adjustment than did their more mature counterparts. This is consistent with reports of worsening diabetic control during the teenage years (Johnson & Rosenbloom, 1982). In fact, our data on coping approaches in the more mature group (see earlier discussion) may suggest mechanisms by which medical adjustment is undermined (i.e., secondary control coping that involves an "I don't care" attitude and that dismisses the importance of careful management). These findings emerged with a measure that involved both regimen adherence and diabetes control. Future research is warranted to unravel further the relationships between such child variables as disease knowledge and coping, and adherence versus actual diabetes control.

As noted, three adjustment measures (medical adjustment, sociobehavioral adjustment, and conduct problems) were found to relate to child variables among formal-operational but not pre-formal children, and the reverse was true for a fourth adjustment measure (psychosomatic problems). We have offered conceptual interpretations for these findings, but one artifactual interpretation needs to be considered as well. It is possible that variance for the child variables or adjustment measures might be so much lower in one cognitive-developmental group than the other as to rule out significant correlations in the low-variance group. To explore this possibility, we carried out tests for homogeneity of variance across the two groups, on the four child response measures and the five adjustment measures. Only two of the tests were significant; variance for the groups differed only on the coping measure and diabetes knowledge (both $ps < .05$). On the knowledge measure, variance was actually greater for the *pre-formal* group (i.e., the group for which no significant correlations with adjustment emerged). Thus, the possibility that apparent developmental differences were actually the result of group differences in variability on this measure appears implausible. However, on the coping style measure, variance was lower among pre-formal than formal-operational children. Thus, although the differential variance interpretation appears implausible for most of our findings, such an artifactual interpretation cannot be ruled out in the case of the group differences in relations between coping and sociobehavioral adjustment.

Methodological explanations aside, the current findings may reflect actual developmental differences; several conceptual possibilities may help account for the fact that diabetes knowledge, coping style, and perceived coping efficacy were related to the adjustment of formal operational but not pre-formal children. We have noted that disease knowledge may contribute to more competent autonomous performance of self-care tasks among more mature youngsters, who are apt to have considerable responsibility for disease management, but that knowledge may be less essential to the adjustment of less mature children, whose self-care activities are seldom autonomous and are often subject to close parental monitoring. Similarly, styles of coping may play a relatively minor role in the adjustment of pre-formal children, as the import of child coping style may be diminished by parental or family functioning. However, for more cognitively mature and autonomous youngsters, effective ways of coping may need to replace the buffer of close parental monitoring.

Finally, several possibilities may account for the relations observed between perceived coping efficacy and parent ratings of adjustment (both SBAS and CPQ measures) for the formal-operational, but not the pre-formal children. We suggested earlier that formal-operational youngsters may be more likely than pre-formal children to use criteria similar to those of their parents in assessing their coping competency. It is also possible that formal-operational youngsters are better able to form adult-like abstractions about themselves (e.g., "how I am doing") from multiple instances of their own social behavior (see Flavell, 1963). This might explain why coping efficacy (significantly) and perceived control (marginally) were related to conduct problems in the formal-operational group, but coping efficacy (marginally) and perceived control (significantly) were only related to somatic problems (i.e., rather concrete indicators) in the pre-formal group.

In sum, the study provided preliminary evidence that potentially important relationships between children's coping and adjustment to diabetes are qualified by level of cognitive development. This finding underscores the notion of interplay between development and adjustment. It implies that, in both our research and clinical approaches to understanding adjustment in chronically ill children, we should recognize that the most relevant processes may differ from one developmental period to the next. The present findings, however, are merely a starting point. Systematic investigation of the impact of cognitive development on various features of child adaptation is needed, both to guide attempts to enhance children's adjustment, and to enrich our understanding of the links between psychosocial and developmental processes in children facing the stress of chronic illness.

References

Band, E. B. (1990). Children's coping with diabetes: Understanding the role of cognitive development. *Journal of Pediatric Psychology, 15,* 27–41.

Band, E. B., & Weisz, J. R. (1988). How to feel better when it feels bad: Children's perspectives on coping with everyday stress. *Developmental Psychology, 24,* 247–253.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84,* 191–215.

Cerreto, M., & Travis, L. (1984). Implications of psychological and family factors in the treatment of diabetes. *Pediatric Clinics of North America, 31,* 689–710.

Collier, G., & Etzweiler, D. (1971). Comparative study of diabetes knowledge among juvenile diabetics and their parents. *Diabetes, 20,* 51–57.

Delamater, A. M. (1986). Psychological aspects of diabetes mellitus in children. In B. B. Lahey & A. E. Kazdin (Eds.), *Advances in clinical child psychology* (Vol. 9, pp. 333–369). New York: Plenum.

Delamater, A. M., Kurtz, S. M., Bubb, J., White, N. H., & Santiago, J. V. (1987). Stress and coping in relation to metabolic control of adolescents with Type I diabetes. *Journal of Developmental and Behavioral Pediatrics, 8,* 136–140.

Eiser, C., Patterson, D., & Town, R. (1985). Children's knowledge of diabetes and implications for self-care. *Diabetic Medicine, 2,* 288–291.

Field, H. S., & Armenakis, A. A. (1974). On the use of multiple tests of significance in psychological research. *Psychological Reports, 35,* 427–431.

Flavell, J. H. (1963). *The developmental psychology of Jean Piaget.* Princeton, NJ: Van Nostrand.

Folkman, S. (1984). Personal control and stress and coping processes: A theoretical analysis. *Journal of Personality and Social Psychology, 46,* 839–852.

Galatzer, A., Frish, M., & Laron, Z. (1977). Changes in self-concept and feelings toward diabetic adolescents. In Z. Laron (Ed.), *Pediatric and adolescent endocrinology: Vol. 3. Psychological aspects of balance of diabetes in juveniles* (pp. 17–21). Basel, Switzerland: Karger.

Garner, A., & Thompson, W. (1974). Factors in the management of juvenile diabetes. *Pediatric Psychology, 2,* 6–7.

Goyette, C. H., Conners, C. K., & Ulrich, R. F. (1978). Normative data on revised Conners parent and teacher rating scales. *Journal of Abnormal Child Psychology, 6,* 221–236.

Hamburg, B. A., & Inoff, G. E. (1982). Relationships between behavioral factors and diabetic control in children and adolescents: A camp study. *Psychosomatic Medicine, 44,* 321–339.

Harter, S. (1983). Developmental perspectives on the self-system. In P. H. Mussen (Ed.), *Handbook of child psychology* (4th ed., Vol. 4, pp. 275–385). New York: Wiley.

Ingersoll, G. M., Orr, D. P., Herrold, A. J., & Golden, M. P. (1986). Cognitive maturity and self-management among adolescents with insulin-dependent diabetes mellitus. *Journal of Pediatrics, 108,* 620–623.

Johnson, S. B. (1984). Knowledge, attitudes, and behavior: Correlates of health in childhood diabetes. *Clinical Psychology Review, 4,* 503–524.

Johnson, S. B., Pollack, T., Silverstein, J. H., Rosenbloom, A., Spillar, R., McCallum, M., & Harkavy, J. (1982). Cognitive and behavioral knowledge about insulin dependent diabetes among children and parents. *Pediatrics, 69,* 708–713.

Johnson, S. B., & Rosenbloom, A. L. (1982). Behavioral aspects of diabetes mellitus in childhood and adolescence. *Pediatric Clinics of North America, 5,* 357–369.

Koski, M. L. (1969). The coping process in childhood diabetes. *Acta Paediatrica Scandinavia, 198*(Suppl.), 7–56.

Kurtz, S. M., & Delamater, A. M. (1984). Family interactions, adherence, and metabolic control in IDDM. *Diabetes, 33*(Suppl. 1), 78A.

Lunzer, E. A. (1968). Formal reasoning. In E. A. Lunzer & J. F. Morris (Eds.), *Development in human learning* (pp. 266–300). London: Staples.

Marrero, D. G., Golden, M. P., Kershnar, A., & Myers, G. L. (1982). Problem-focused versus emotion-focused coping styles in adolescent diabetics. *Pediatric and Adolescent Endocrinology, 10,* 141–146.

Moffat, M. E. K., & Pless, I. B. (1983). Locus of control in juvenile diabetic campers: Changes during camp, and relationship to camp staff assignments. *Journal of Pediatrics, 103,.* 146–150.

Nicholls, J. G., & Miller, A. T. (1984). Development and its discontents: The differentiation of the concept of ability. In J. G. Nicholls (Ed.), *The development of achievement motivation* (pp. 185–218). Greenwich, CT: JAI.

Orr, D. P., Golden, M. P., Myers, G., & Marrero, D. G. (1983). Characteristics of adolescents with poorly controlled diabetes referred to a tertiary care center. *Diabetes Care, 6,* 170–175.

Piaget, J. (1970). Piaget's theory. In P. E. Mussen (Ed.), *Carmichael's manual of child psychology* (3rd ed., Vol. 1, pp. 703–732). New York: Wiley.

Rothbaum, F., Weisz, J. R., & Snyder, S. S. (1982). Changing the world and changing the self: A two-process model of perceived control. *Journal of Personality and Social Psychology, 42,* 5–37.

Sanders, K., Mills, J., Martin, F. I. R., & Horne, D. J. D. (1975). Emotional attitudes in adult insulin-dependent diabetics. *Journal of Psychosomatic Research, 19,* 241–246.

SPSS Inc. (1983). *SPSSx user's guide.* New York: McGraw-Hill.

Strickland, B. R. (1978). Internal–external expectancies and health-related behaviors. *Journal of Consulting and Clinical Psychology, 46,* 1192–1211.

Tennen, H., Affleck, G., Allen, D. A., McGrade, B. J., & Ratzan, S. (1984). Causal attributions and coping with insulin-dependent diabetes. *Basic and Applied Social Psychology, 5,* 131–142.

Weiss, B., & Weisz, J. R. (1988). Factor structure of self-reported depression: Clinic-referred children versus adolescents. *Journal of Abnormal Psychology, 97,* 492–495.

Weisz, J. R. (1986). Understanding the developing understanding of control. In M. Perlmutter (Ed.), *Cognitive perspectives on children's social and behavioral development: The Minnesota symposia on child psychology* (Vol. 18, pp. 219–285). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Weisz, J. R., Rothbaum, F. M., & Blackburn, T. C. (1984a). Standing out and standing in: The psychology of control in America and Japan. *American Psychologist, 39,* 955–969.

Weisz, J. R., Rothbaum, F. M., & Blackburn, T. C. (1984b). Swapping recipes for control. *American Psychologist, 39,* 974–975.

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