JOURNAL OF PERSONALITY ASSESSMENT, *79*(1), 122–141

Rorschach Variables Related to Blood Glucose Control in Insulin-Dependent Diabetes Patients

Serge Sultan
Department of Psychology
University of Burgondy

Ahmed Jebrane
Department of Mathematics
University of Burgondy

Agnes Heurtier-Hartemann
Department of Diabetology
Pitie-Salpetriere Hospital
Paris, France

In this article, we explored relations between selected Rorschach variables and blood glucose control in Insulin-Dependent Diabetes Mellitus (IDDM) patients. Three domains of psychological functioning are taken into consideration: emotional distress, coping and problem solving, and cognitive efficiency. Seventy-one IDDM patients (38 men, 33 women; mean age 42.2 ± 14.9 years) from an outpatient unit took the Rorschach Comprehensive System (Exner, 1986). Nine variables were selected as independent variables. Blood glucose, a dependent variable, was measured by the proportion of glycated hemoglobin. Results of 2 regression analyses show that Y and C' correlate to higher blood glucose. WSum C and the absence of texture related to lower levels of blood glucose. A confounding effect of complications was observed. The findings suggest that emotional factors should be accorded greater attention in behavioral self-regulations in diabetes.

Diabetes is a major public health issue. It is associated with long-term complications including heart disease and renal disease. Insulin-Dependent Diabetes

Mellitus (IDDM or Type 1 diabetes) is caused by a combination of genetic and autoimmunological processes that destroy the pancreatic cells that produce insulin, a hormone essential for glucose utilization and storage. The resulting insulin deficiencies lead to various major metabolic problems. IDDM can occur at any age but is typically diagnosed during childhood and adolescence. Research strongly suggests that chronic hyperglycemia is a major factor contributing to long-term complications. The Diabetes Control and Complications Trial Research Group (1993) demonstrated the relation between long-term glycemic control and diabetic complications. It is therefore of great importance to isolate the correlates and determinants of long-term hyperglycemia in persons suffering from this disease. Diabetes is one of the most psychologically and behaviorally demanding of the chronic medical illnesses, and various psychosocial factors have long been recognized as relevant to nearly every aspect of diabetes and its treatment (Fisher, Delamater, Bertelson, & Kirkley, 1982).

A BEHAVIORAL REGULATION PROCESS

Recent conceptualizations have focused on IDDM as involving a complex series of self-care behaviors. Patients must follow a strict regimen that can be considered within a behavioral self-regulation model for the control of blood sugar (Wing, Epstein, Nowalk, & Lamparski, 1986). This model is based on a negative feedback control system and includes four components: (a) behaviors related to the detection of discrepancies between actual and normal blood sugar, by means of blood sugar monitoring; (b) corrective responses, such as the use of insulin, to normalize blood sugar; (c) minimization of disturbances to the system through behaviors such as stress reduction or dietary modification; and (d) self-reinforcement or self-regulatory behaviors. For example, as for the adoption of corrective responses, treatment traditionally focuses on behaviors that are designed to change blood sugar, such as an adjustment in the amount or type of insulin injected or, in some cases, exercising. If blood sugar is too low, eating may be appropriate as may be the injection of glucagon or epinephrine.

However, this behavior-focused approach may hide many individual psychological factors concerning stable or unstable aspects of people's functioning and personality, which may indirectly influence glycemic control by modifying any of the four components identified by Wing et al. (1986). We addressed some of these factors in this study.

RORSCHACH STUDIES IN IDDM PATIENTS

Few studies have used the Rorschach to explore psychological processes in diabetes. We performed a systematic search in the PsycINFO and Medline electronic databases using the two key words *Rorschach* and *diabetes*. For the 1971 to 2000 period, only seven articles directly focused on diabetes and used the Rorschach as an individual assessment method. Most research has centered on determining the psychological specificities of diabetics. Two studies used control groups for comparison. McCraw and Tuma (1977) found no differences between 25- to 26-year-old children with diabetes and adolescents and 25 controls matched for age and sex when responsivity was controlled for. The protocols were compared on content categories of anxiety, hostility, penetration, and barrier. Faellstroem and Vegelius (1978) examined the ability of Rorschach variables to discriminate between a group of IDDM children and adolescents and a control group (16 participants each). They applied their discrimination function to another group of 32 participants who were unaware of their health status. The authors found their classification accorded with the genuine health status of all the participants but 1. The variables involved in the discriminant function relate to a negative body image (morbid responses) and the penetration score. Andronikof-Sanglade (1986) explored the relations between Rorschach characteristics and duration of the illness in a cross-sectional study in a group of 23 children (7 to 17 years old). Children with recent diabetes onset showed more anxiety or negative affects (as measured by Y, C', and V), whereas children with earlier diabetes onset expressed more disturbances in their body image (as reflected by frequent morbid responses and a lower EGO index).

Certain other studies did not use control groups and their interpretations seem more intuitive than empirically based. For example, Appelbom-Fondu, Verstraeten, and Dopchie (1974) conducted psychiatric and psychological examinations including the Rorschach of seven male and seven female adolescents (age range 13 to 15 years). No general feature could be evidenced in the groups. However, they concluded by interpreting their case studies as suggesting that adolescents with diabetes are at high risk of psychological difficulties. Monedero-Gil and Ruiz de Albacete (1977) administered a set of psychological tests, including the Rorschach, to 52 young people with diabetes (aged 6 to 28 years). They observed that participants with diabetes showed neither a more frequent deficit in intellectual development nor a higher incidence of psychopathology than what is usually observed in nondiabetic populations. However, the results obtained by means of the Rorschach were not detailed in their report.

Only two studies have addressed the question of the relation to blood glucose. Koch and Molnar (1974) tried to relate clinical characteristics (continuous monitoring of blood glucose and biochemical variables) to Rorschach, Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1943), and Bender gestalt variables. They found no relation, but their results could be due to the method used for measuring glycemic control (urine test), which was at that time nowhere near as accurate as the methods now available. Di Iullo, Ranzini, and Zavattini (1985) examined the personality features of 30 female participants with diabetes (10 to 26 years old) and 30 healthy participants matched for age and socioeconomic status. Although their results do not suggest any differences in personality between the two groups, when metabolic control was considered as a variable it was related to a better self-image. This was observed through the analysis of content features such as morbid responses. However, no structural variable was considered in their analysis.

To summarize, all the articles indexed since 1971 deal with children or adolescents and no study has yet explored Rorschach factors in IDDM adults. In addition, no recent study has clearly addressed the question of the relation between Rorschach factors and blood glucose in IDDM patients. In our view this is of major importance because empirical studies using other measures have found that core psychological factors relate strongly to glycemic control (see next section). Moreover, little interest has been paid to structural Rorschach variables because most reports almost exclusively include content variables.

PSYCHOLOGICAL CORRELATES OF GLYCEMIC CONTROL

Three main areas of psychological functioning have been related to glycemic control in IDDM patients: emotional factors, particularly emotional distress; coping and problem solving; and, to a lesser extent, cognitive efficiency.

Emotional Distress

The relation between negative emotions and glycemic control involves both the psychological impact of diabetes and the role of psychological stress in diabetes management. Several studies have found a higher incidence of depression and anxiety disorders in IDDM patients, independently of such factors as diabetic complications and loss of function (e.g., Geringer, Perlmuter, Stern, & Nathan, 1988). In the same vein, epidemiological data suggest that the course of depression is more severe in populations with diabetes (Lustman, Griffith, & Clouse, 1988). Psychosocial problems can occur as a side effect of numerous negative diabetes-related experiences including diagnosis, increased stress, and onset of complications (Wulsin, Jacobson, & Rand, 1987). However, the relation between negative emotions and diabetes also involves the effect of stress on blood glucose. Stress can directly affect blood glucose through the release of stress hormones (e.g., epinephrine, which elevates glucose) or indirectly affect blood glucose by disrupting self-care behaviors. It has been possible to demonstrate this both in the laboratory and in field studies (Cox & Gonder-Frederick, 1992). However, in the long run it seems that the effect of negative emotions on glycemic control is a more powerful explanation when considered as an indirect factor (i.e., disrupting self-care behaviors). For example, arguments concerning the impact of anxiety on glycemic control can be found in the effect of relaxation training on metabolic control. This appears to be beneficial for patients with diabetes (Bishop, 1994; Padgett, Mumford, Haynes, & Carter, 1988).

However, most field research into the link between emotions and blood glucose are cross-sectional and therefore cannot isolate causal relations. Thus, the observed links could be interpreted equally well as the emotional impact of poor glycemic control-related negative experiences or in terms of the difficulty that people experiencing negative emotions have in achieving a long-term blood glucose balance. To hypothesize a causal relation between negative emotions and blood glucose, a cross-sectional study would need to control for at least one major characteristic of the illness directly related to poor glycemic control, that is, the presence of complications (such as in the study by Geringer et al., 1988). In our study this issue was addressed by exploring the role of potential confounds.

Coping and Problem Solving

There is growing evidence that psychosocial variables may buffer negative effects of stress on blood glucose, including social support and coping styles. As noted by Maes, Leventhal, and De Ridder (1996), coping with diabetes is different from some of the other chronic diseases because it is one of the rare chronic diseases that by and large allows patients to control their own well-being. Many patients with diabetes seem to be able to fulfill the demands their disease imposes on them just as many succeed in coping in a problem-focused way (see, e.g., Frenzel, McCaul, Glasgow, & Schafer, 1988). Frenzel et al. observed that up to 80% of the coping attempts made by patients with diabetes involved active (cognitive or behavioral) strategies. Most authors claim that good diabetes management is the result of problem-focused coping styles (Cox & Gonder-Frederick, 1992). Many results suggest that it is only through active coping that patients are able to maintain their demanding regimen (Grey et al., 1998; Hanson, Cigrang, Harris, & Carle, 1989). The role of coping reactions on glycemic control has most frequently been investigated within a perspective that considers coping to be a personality style. A consistent body of research suggests that there is a strong relation between glycemic control and problem-focused reactions (Maes et al., 1996). For example, Smari and Valtysdottir (1997) found evidence of a clear relation between a problem-focused coping style and glycemic control in a sample of 93 IDDM adults. They also observed a correlation between emotional coping reactions and long-term high blood glucose, whereas avoidance strategies were not related to this variable. In children, Hanson et al. (1989) and Grey, Lipman, Cameron, and Thurber (1997) observed that failure in glycemic control was related to avoidance. Peyrot and McMurry (1992) showed that coping reactions could have a buffering effect on the relation between negative emotion and glycemic control in a sample of 105 IDDM participants. These data indicate that active and problem-focused coping styles are usually found to be associated with better metabolic control.

Cognitive Efficiency

The behavioral regulation process demands that participants perform various tasks that require certain specific abilities in detecting and measuring discrepancies, making decisions on corrective actions, remaining vigilant concerning disturbances to the system, and planning self-reinforcement procedures. Any failing in these abilities or skills could be the cause of disruption in treatment or regimen. Evidence for this can be found in surveys showing that patients experiencing difficulties in reality testing have poorer control of their blood glucose level (see, i.e., Berlin et al., 1997). Thus, thinking logically and coherently seems an absolute condition for achieving long-term glycemia balance. In addition, education is also probably related to better metabolic control (Bishop, 1994). This is evident when self-regulations in IDDM are taken into consideration. Therefore, when searching for psychological correlates of glycemic control, education level should be considered. It is probable that intelligence plays a similar role although we could not find any empirical support for this and consequently ignored this variable. A third aspect related to cognitive functioning seems central to the question of glycemia balance. The behavioral regulation process requires people to devote large amounts of energy to the processing of different kinds of information. Thus, the amount of processing activity can be thought of as one of the determinants of glycemic control. Inadequate information processing capacities will probably induce inefficiency in behavioral glucose regulation. Thus, both the theory and the empirical results suggest that, for IDDM patients, regulating blood glucose is likely to be influenced by emotional, coping and problem solving, and cognitive factors. However, these have seldom (or never) been explored with the Rorschach method.

This analysis led us to formulate two hypotheses. First, we hypothesized that selected Rorschach variables should correlate to glycemic control in the three areas of (a) emotional distress, (b) coping styles and problem-solving capacities, and (c) cognitive efficiency. This should confirm previous results from the non-Rorschach literature. We expected the variance of glycemic control explained by Rorschach variables to be high, although no comparison level was available. Second, we hypothesized that the observed correlations would be relatively stable even when potential confounding variables were controlled for. Specifically the presence of complications can be considered to be a confound in the distress/high blood glucose relation because such characteristics of illness are related to poor glycemic control and are simultaneously likely to generate strong negative feelings.

METHOD

Participants

Eighty-three adults were recruited from an outpatient unit of Pitie-Salpetriere Hospital in Paris, France. However, in accordance with Exner's (1991) suggestions, all protocols with a Number of Response (R) lower than 14 were excluded from further analysis (see following). These patients did not differ from the clinical sample in terms of demographic data or glycemic control. Thus the clinical sample was composed of 71 participants. This was not strictly randomized, although we chose at random two half-day consultations per week during which all the patients were systematically included in the study. Ninety were asked to participate but 7 declined. These patients did not differ from the clinical sample in either demographic data or glycemic control. Inclusion criteria were as follows: medical diagnosis made by an experienced diabetologist (IDDM, Type 1), participants suffering from diabetes for more than 1 year, no pregnancy, and age range 18 to 65 years. Participants suffering from another chronic illness were excluded (such as heart disease, or cancer, or any psychiatric difficulties likely to seriously disturb reality testing or personal judgment). This screening was performed by means of an interview conducted by an experienced psychologist. The criteria for assessing serious disturbances in reality testing or personal judgments were those used in the diagnosis of psychoses (*Diagnostic and Statistical Manual of Mental Disorders,* 4th ed., American Psychiatric Association, 1994, Axis I). The age range of participants was 18.1 to 65 years (M = 42.2, SD = 14.9 years). The participants consisted of 38 men and 33 women. Twenty (28.2%) were single, 37 (52.1%) were married, 11 (15.5%) were separated or divorced, and 3 (4.2%) were widowed. Education level was as follows: 0 to 5 years, 2.8% of the clinical sample; 6 to 8 years, 9.8%; 9 to 10, 18.3%; 11 to 13 years, 26.7%; and 14 years and over, 42.2%. Mean age at onset and diabetes duration was 23.7 years (SD = 11.8) and 18.4 years (SD = 13), respectively. Thirty had complications (42.3%); 25 suffered from retinopathy with a serum creatinine level guaranteeing normalized eyesight and the ability to take the Rorschach, 3 from renal disease, and 2 from peripheral vascular disease.

Instruments and Selection of Variables

This study was presented as dealing with psychological factors associated with the management of diabetes. After filling a written consent form, the participants were submitted to the Rorschach method (Comprehensive System [CS]; Exner, 1986). This was administered and scored by a trained psychologist (Serge Sultan) who was unaware of the participants' health status and glycemic control at the time of assessment. The administration was performed before the medical consultation. The sociodemographic data and characteristics of illness (including blood glucose levels) were taken from the patient's file by the medical staff after the medical consultation. We were mainly interested in the following data: age, sex, age at onset, diabetes duration, education, presence of complication, and type of complication.

The following nine Rorschach CS variables were selected as independent variables to match the three domains of psychological functioning likely to relate to glycemic control:

1. Emotional distress: Color-Shading Blends > 0, Sum T > 1, Sum V > 0, Sum Y > 1, Sum C' > 1 (all variables considered as categories).
2. Coping styles and problem solving: Sum M, WSum C, presence of an EB PER (last variable considered as a category).
3. Cognitive efficiency: WSum6 Critical Special Scores, Zf.

This selection of variables is based on two types of information: first on empirical definitions of variables given by Exner (1991) and Weiner (1998) and second on statistical constraints—we preferred primary measures (as opposed to computed indexes or scores) to avoid any potential colinearity that might impair the regression calculations.

Glycemic control was considered as a dependent variable and measured by the level of glycated hemoglobin (HbA_{1C}), a short-lived protein that is structurally altered by the attachment of glucose molecules. Thus HbA_{1C} acts as a biological marker of glycemia over a 2- to 3-month period (Schiffreen, Hickingbotham, & Brown, 1980).This was assessed using the High Pressure Liquid Chromatography technique that is the current standard. In our laboratory, norms for nonconsultants range from 4% to 5.6%. To ensure that we were considering a relatively stable measure, we averaged the last three levels of HbA_{1C} to obtain a valid and reliable measure of glycemic control over the 7 to 9 months before assessment. In the following, we refer to this computed score as HbA_{1C}. The higher the HbA_{1C} score the poorer the glycemic control (i.e., high blood glucose in the long run). In our sample, the mean level for HbA_{1C} was 8.125% ($SD = 1.362$, $Mdn = 8$), which is comparable to other diabetic samples (Smari & Valtysdottir, 1997).

Data Analysis

Four participant characteristics (age, age at onset, duration of illness, presence of complication)and three Rorschach variables (R, Lambda, EB style) were examined as potential confounding factors. Pearson correlations with HbA_{1C} levels were computed for the participant and illness variables. In the case of the Rorschach variables, nonparametric tests were used or, alternatively, the variables were transformed into categories in line with interpretation thresholds (Exner, 1991; Weiner, 1998). The Rorschach protocols of 18 participants were chosen at random and rescored by a separate colleague who was also unaware of their health status and glycemic control. Interscorer reliability measures were obtained for eight major categories of Rorschach CS variables, as recommended by Exner, Kinder, and Curtiss (1995). Relations between Rorschach variables and glycemic control (HbA_{1C}) were examined by means of a multiple-regression analysis in which the independent variables were Rorschach variables and the dependent variable was glycemic control. A stepwise procedure was chosen to permit a comparison between predictors on the basis of probability criteria. This made it possible to conduct a second multiple-regression analysis to explore the role of confounds and the stability of the first model obtained. This was done by forcing potential confounds into the model and examining the stability between the two models.

RESULTS

Reliability Measures

The measures of interscorer reliability were good for the Rorschach variables. The percentage of agreement between scorers was as follows for each major category of CS variables: (a) Location & DQ, 92.4%; (b) Determinants, 88.1%; (c) FQ, 92.6%; (d) Pairs, 99.4%; (e) Contents, 89.5%; (f) Populars, 98.9%; (g) Z score, 98.9%; and (h) Special Scores, 84.4%. For each of these categories, agreement measures met the standards recommended by Exner et al. (1995).

A 100% interjudge agreement was obtained between two experienced diabetologists on the following variables: medical diagnosis (IDDM, Type 1), presence or absence of complications, and type of complication. As for the biological marker of blood glucose, previous studies showed that the technique used for measuring HbA_{1C} is highly reliable. Exploratory analyses indicate that the averaged last three measures were highly correlated in our sample ($r > .85$).

Potential Confounding Variables

An alpha level of .05 was used for all statistical tests. To allow future comparisons with the existing literature, we performed two different analyses for each pair of examined variables. First, HbA_{1C} was considered as a continuous variable and relations with potential confounding variables were tested (cf. Bott, Bott, Berger, & Mühlhauser, 1997). Second, two groups were formed according to their HbA_{1C} level either below the median ($\leq 8\%$, $n = 34$; referred to as the *well-controlled* blood glucose group) or above this level ($> 8\%$, $n = 37$; referred to as the *poorly controlled* blood glucose group; cf. Berlin et al., 1997).

Pearson correlations between HbA_{1C} levels and age, age at onset, and diabetes duration were not significant (*r*s < .13, *p*s > .90). This was also confirmed when the well-controlled group was compared with the poorly controlled group, *t*s(71) < –1.803, *p*s > .09. However, the presence of complications was associated with a higher HbA_{1C} ($M = 8.814$) when complicated than when not complicated ($M = 7.621$), $t(71) = -3.865$, $p < .001$. When well-controlled participants were compared to the poorly controlled participants, this result was confirmed, the corrected value being $\chi^2(1, N = 71) = 14.313$, $p < .001$. This therefore indicates that the role of complications should be taken into consideration in subsequent analyses.

Education level was negatively related to HbA_{1C} (Spearman $\rho = -.294$, $p > .05$), and this was confirmed by the group comparison (Mann–Whitney $U = 826.5$, $p = .016$). This suggests that education level should be considered as a potential confound in multivariate analyses. As for Rorschach variables, R was higher in participants with poor control of their blood glucose ($U = 458.0$, $p < .049$). However, when HbA_{1C} was considered as a continuous quantity, the rank order correlation appeared to be moderate ($\rho = .235$, $p = .05$). This also means that responsivity should be considered to be a potential confounding factor in subsequent multivariate analyses. As far as Lambda values are concerned, no significant relation with HbA_{1C} was observed ($\rho = -.099$ when this variable was considered as a continuous value; $U = 620.5$, $p > .922$ when the two groups were compared). Three modalities of EB Style were also considered: Introversive ($n = 12$), Ambitent ($n = 36$), and Extratensive ($n = 23$; as defined in Weiner, 1998). Mean levels of HbA_{1C} for each of these styles were compared. A one-way analysis of variance for group means revealed no overall effect, $F(2, 68) = .175$, $p = .840$. This was confirmed by the chi-square analyses, $\chi^2(2, N = 71) = .362$, $p = .835$, when two HbA_{1C} groups were compared. Overall, we believed it to be extremely important to consider the potential confounding effects of complications, education level, and responsivity in further analyses.

Rorschach Variables Description

Tables 1 and 2 include descriptive statistics for each of the Rorschach variables studied in the clinical sample. This information is presented to allow a closer inspection of the distributions of these variables (Viglione, 1997). We include a description of the raw variables although for most variables category was used in the ensuing multivariate analyses.

Relations to Glycemic Control

We performed two multiple-regression analyses. The first explored the relations between Rorschach variables (independent variables) and HbA_{1C} (dependent variable). The results are summarized in Table 3. Positive coefficients showed a posi-

TABLE 1
Descriptive Data for Emotional Distress Rorschach Variables

Rorschach Variables	*M*	*SD*	*Minimum*	*Maximum*	*Mdn*	*f*	*Skew*	*Kurtosis*
Sum T	0.704	0.835	0	3	0		0.913	–0.070
Sum T = 0						36		
Sum T = 1						22		
Sum T > 1						13		
Sum V	0.592	0.838	0	4	0		1.800	3.924
Sum V = 0						40		
Sum V > 0						31		
Sum Y	0.958	1.088	0	4	1		1.181	0.905
Sum Y ≤ 1						54		
Sum Y > 1						17		
SumC'	1.620	1.346	0	5	1		0.914	0.419
SumC' ≤ 1						39		
SumC' > 1						32		
Col-Shd Bld	0.634	0.945	0	3	0		1.432	1.024
Col-Shd Bld = 0						43		
Col-Shd Bld > 0						28		

Note. $N = 71$. f = the number of participants for each category used.

TABLE 2
Descriptive Data for Coping and Cognitive Efficiency Rorschach Variables

Rorschach Variables	*M*	*SD*	*Minimum*	*Maximum*	*Mdn*	*f*	*Skew*	*Kurtosis*
Coping								
Sum M	2.577	2.061	0	10	2	—	1.307	2.082
WSum C	2.993	2.229	0	10	3	—	1.178	1.506
EB PER	–0.287	2.556	–5	10	–1.130		1.181	0.905
No						32		
Yes						39		
Cognitive efficiency								
WSum6	8.592	8.545	0	34	6	—	1.323	1.179
Zf	10.817	3.929	5	25	10	—	1.133	1.791

Note. $N = 71$. f = the number of participants for each category.

tive correlation with the level of HbA_{1C} (i.e., with a difficulty in balancing blood glucose), whereas negative correlations indicated better glycemic control. There are significant relations concerning the three sets of variables discussed previously: emotional distress and negative emotions (Sum Y > 1, Sum C' > 1), cognitive efficiency (WSum6), and coping and problem solving (WSum C). Contrary to expectations, no relations with other aspects of emotional difficulty as measured by Sum

V > 0, Sum T > 1, and Col-Shd Bld > 0 were observed. Similarly, our measure of the amount of energy dedicated to processing information (Zf, cognitive efficiency) did not appear to be negatively related to HbA_{1C} (i.e., did not contribute to better glycemic control). As for coping and problem-solving capacities, only WSum C related negatively to HbA_{1C} and thus contributed to better control of blood glucose. This does not mean that an extratensive EB Style related to a better glycemic control (see descriptive data). Sum M and the presence of an EB PER were excluded from the model (unrelated to HbA_{1C}). One surprising result is the negative correlation observed with Sum T = 0. This relation was not expected and shows that some personality features are more frequent when blood glucose is well controlled.

When R was forced into the regression model (data not shown), this remained stable with all directions of correlations and significances remaining the same. Only minor changes were observed in coefficient values. R appeared unrelated to HbA_{1C} in this multivariate model, $F(1, 71) = .563$, $p = .46$. Thus, responsivity can be considered as having no confounding or biasing effects on the Rorschach variables/blood glucose relations.

It seems that affective variables played a major role in predicting the HbA_{1C} level. In fact, the first four predictors relate to affective states. The overall model composed of psychological variables explained 47% of the adjusted variance of the biological HbA_{1C}, which is close to the symbolic 50% threshold. Hence, as far as Rorschach variables are concerned, the model presented in Table 3 makes it possible to isolate correlates of glycemic control. Yet the importance of emotional variables could be due to potential confounds. Some characteristics of the patient or the illness (e.g., those influencing its severity) could induce negative feelings responsible for the expression of Y, C', and even critical Special Score responses.

Table 4 summarizes the second analysis we performed to control for such potential confounds, namely the presence of complication and education. This sec-

TABLE 3
Summary of Stepwise Multiple-Regression Analysis for Rorschach Variables Predicting Glycemic Control (HbA_{1c})

Step	*Variable*	*B*	*SE B*	β	ΔR^2
1	Sum Y > 1	1.96	0.29	.62***	.24***
2	WSum C	–0.25	0.06	–.41***	.05*
3	Sum T = 0	–0.90	0.25	–.33***	.11***
4	SumC' > 1	0.67	0.25	.25**	.07**
5	WSum6	0.03	0.01	.20*	.04*

Note. $N = 71$. $R^2 = .51$ and $\Delta R^2 = .47$ for global model. Results are for forward procedure. Criterion for selecting variable is $p < .05$ for inclusion and exclusion. Variables excluded from the model: Col-Shd Bld > 0, Sum T > 1, Sum V > 0, Sum M, EB PER, and Zf.

*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 4
Summary of Hierarchical Regression Analysis for Rorschach and Potential Confounding Factors Predicting Glycemic Control (HbA_{1c})

Step	*Variable*	*B*	*SE B*	β	ΔR^2
1	Sum Y > 1	1.69	0.30	.53***	.24***
2	WSum C	–0.17	0.06	–.28**	.05*
3	SumC' > 1	0.84	0.24	.31**	.10**
4	Sum T = 0	–0.65	0.23	–.24**	.08**
5	Presence of complications	0.83	0.24	.30**	.08**

Note. $N = 71$. $R^2 = .55$ and $\Delta R^2 = .52$ for global model. Results are for forward procedure. Criterion for selecting variable is $p < .05$ for inclusion and exclusion. Rorschach variables excluded from the model: Col-Shd Bld > 0, Sum T > 1, Sum V > 0, Sum M, EB PER, WSum6, and Zf.
*$p < .05$. **$p < .01$. ***$p < .001$.

ond multiple-regression analysis included complications and education level as independent variables added to those previously included. HbA_{1C} remained the dependent variable. As was observed in bivariate analyses, the presence of complications was associated with a higher HbA_{1C}, that is, a difficulty in balancing blood glucose. Complications were shown to be a nonredundant significant predictor of the HbA_{1C} level (Step 5, $\Delta R^2 = .081$, $p < .01$) and was selected as the fifth best predictor of HbA_{1C}. Education level was not indicated as a potential predictor by the stepwise procedure ($p > .05$). We forced this variable into the model shown in Table 4 (multiple regression with all effects). This variable brought little additional information ($\Delta R^2 = .0012$, $p > .68$) and was unrelated to HbA_{1C} ($B = –.045$, $SE\ B = .108$, $\beta = –.037$, $p = .68$). Education level also did not change the hierarchy of predictors, directions of correlations, and significances of coefficients.

In the second analysis (Table 4), the introduction of neither complications nor education level in predictors greatly modified the relations observed in Table 3. Two minor differences concern (a) the relatively lower significance of the negative correlation of WSum C to HbA_{1C} and (b) the variation in the hierarchy of predictors: Sum C' > 1 was a better predictor than Sum T = 0 in this second analysis (in both regression analyses the criterion for selecting and ordering predictors was the *p* value). One more important change was that the correlation implying WSum6 was no longer significant. This means the relation previously observed between some kind of cognitive impairment and poor glycemic control was due to the presence of somatic complications in our sample. It is therefore possible that complications might be responsible for a relative cognitive disorganization. As can be observed in Table 4, no additional variable was included in the model after the introduction of both complications and level of education. This means no other relation involving the selected Rorschach variables was hidden by the potential confounds. In this second analysis, the adjusted variance of HbA_{1C} explained by the model was more than 52%.

These results show that the selected Rorschach variables are related to glycemic control and that for most of them these relations do not depend on participant characteristics (like education level) or objective illness characteristics (such as the presence of somatic complications).

DISCUSSION

Rorschach Pattern Associated With Blood Glucose Control

The results show that a specific pattern of psychological functioning was related to glycemic control in our sample of IDDM patients. This is in line with our expectations even though all the variables did not correlate as expected. In particular, it is surprising that neither our measure of cognitive efficiency (Zf) nor that of cognitive impairment (WSum6) related to glycemic control when complications were controlled for. Two psychological domains appeared to relate to HbA_{1C}. First, negative emotions were correlated with poor glycemic control. This observation is independent of the severity of illness. Therefore, we can hypothesize a causal relation in which negative emotion or distress would hinder glycemic control. This confirms previous observations made with other instruments (Polonsky et al., 1995) and probably relates to an indirect and long-term effect of negative emotions that disrupts self-care behaviors in diabetic patients.

The pattern observed should be interpreted in the light of the empirical validation of the different variables selected. Diffuse shading responses (Y) refer to a feeling of distress probably related to a feeling of uncontrolability (McGowan, Fink, Galina, & Johnson, 1992). Some research has suggested a link with anxiety and frustration (Lebo, Toal, & Brick, 1960), although recent results question this interpretation (Eells & Boswell, 1994). This is in line with other studies that have observed that controllability is central in patients' motivation for self-care (Howorka et al., 2000; Sénécal, Nouwen, & White, 2000). The interpretations of C' responses focus on a painful internalized affect. According to Weiner (1998), an elevated Sum C' typically points to feelings of sadness, gloom, unhappiness, and psychological misery. This is confirmed by the literature on C' in depressed patients (e.g., Schlesinger & Fox, 1980). In addition, several studies show that a high Sum C' is indicative of a constriction or internalization of affect (Exner, 1991). Thus, those participants in our sample with high blood glucose (experiencing difficulties balancing their glucose level) exhibited an emotional pattern referring to a feeling of distress and painful internalized affects. This is mostly in line with non-Rorschach literature (for a review, see Polonsky et al., 1995).

The second type of psychological activity related to glycemic control deals with coping and problem solving. One component of the EB played a major role in our model, namely the WSum C. To avoid statistical between-predictors colinearity issues, we decided to consider human movements and color responses separately. Preliminary bivariate analyses revealed that the EB style was unrelated to glycemic control. In this context, relations to the WSum C can be interpreted in two ways.

First, with reference to the EB, WSum C can probably be considered as a measure of the capacity of the participant to act and solve problems using trial-and-error strategies more or less independently of the EB orientation itself (i.e., independently of the number of human movements). In this dimensional perspective, the higher the WSum C, the more the participant is action oriented. This interpretation is supported by research showing a relative independence between human movements and color responses (e.g., Kunce & Tamkin, 1981). Some research on the nonpervasive Introversive or Extratensive EB also lends support to this interpretation because in this case individuals can be emotion or action oriented and ideation oriented without being overly rigid. Therefore, they can use both types of psychological functioning in solving problems (Exner, 1978; Buchwald & Blatt, 1974). In our study, this would mean that glycemic control related to a capacity to act to solve problems and take account of external feedback. In fact, good behavioral glycemic control requires people to process external information, make decisions, and act in response to this environment.

The second interpretation of the relation observed with weighted color responses deals with feeling and the expression of affects. Although this interpretation has been questioned (Franck, 1993; Stevens, Edwards, Hunter, & Bridgman, 1993), most authors now consider that WSum C is indicative of the capacity of participants to experience and express affects (see review in Exner, 1991). For Weiner (1998), at all ages, a WSum C of 2.5 or more indicated a sufficient capacity for processing affects independently of EB Style. This interpretation should be examined in light of the role of achromatic colors in our study: Both WSum C and Sum C' > 1 have converse effects on HbA_{1C}. Therefore, it is highly probable that a constriction of the capacity to express affects is deleterious to controlling self-care behaviors (and consequently blood glucose), whereas an adequate capacity to process affects favors good diabetes management.

Apart from these expected relations, the most surprising result was the positive correlation between the absence of texture (Sum T = 0) and a lower long-term blood glucose. The absence of texture is usually interpreted as a characterological feature. It is thought to identify a type of participant experiencing a basic impairment in the capacity to form close attachments to other people, or people in whom the experience of affective need or dependence has been neutralized (Leavitt, 2000; Marsh & Viglione, 1992; Pierce, 1978). This interpretation finds strong support in the recent literature involving psychopaths and offenders in which Sum T = 0 was shown to be indicative of interpersonal detachment and aversion to closeness (Gacono & Meloy, 1991; Loving & Russell, 2000). However, this raises the question of whether this personality feature is responsible for the good control of diabetes or whether controlling diabetes imposes day-to-day constraints that influence personality in the long term as a result of the attendant learning processes. The interpretation we would favor to account for this result is that diabetes requires a sense of personal responsibility and autonomy. It is possible that diabetes management overdevelops these personal qualities to the point that some patients need to cut themselves off. Hence, this observation would result from an adaptive or self-protection process. This is all the more likely the greater the extent of the strong positive (or negative) feedback when their behavior is appropriate (inappropriate) in terms of blood glucose level control. This, of course, should be confirmed by further research.

Theoretical Considerations

An initial conclusion to be drawn from our results concerns the value of using the Rorschach method in this field. From a quantitative point of view, the proportion of variance of blood glucose control explained by Rorschach variables was quite high and equaled or exceeded the levels obtained in other field studies assessing the same domains of psychological activity. For example, Smari and Valtysdottir (1997) could only explain from 12% to 18% of the variance of HbA_{1C} with a trait measure of coping reaction. Polonsky et al. (1995) explained 9% of this variance using a self-report measure of diabetes-related distress. It is particularly remarkable that psychological variables can predict a high proportion of variance of the biological marker of glycemic control. This reflects the fact that the theoretical model used to understand the behavioral regulation of diabetics (Wing et al., 1986) is a good basis for understanding the relations between psychological factors and health-related behaviors. Nevertheless, most of the variables considered in our study were not taken directly from the behavioral regulation model. Thus, the strong relations observed suggest that other important factors should be included. This is particularly true of emotional functioning that appeared central in our data. Our results suggest that a central role should be attributed to negative emotions and constriction of affect because these contribute to the disruption of self-care behaviors. In the long term, this is probably a major cause of high blood glucose and consequently a risk factor for the development of somatic complications.

One result of this study relates to our second hypothesis. When controlling for some illness characteristics (like severity; here, the presence of complications), it is possible to infer a causal direction from the observed relations. This concerns the emotional variables that we think influence blood glucose by disrupting long-term behavioral regulation. However, although certain arguments favor this interpretation, the cross-sectional design of our experiments precludes us from stating conclusively that such a link exists. There is a great need in this field for longitudinal studies to isolate determinants of glycemic control. Also, we did not include all the characteristics of the illness that could be controlled for. Other potential confounds may play an unsuspected but nevertheless important role.

Clinical Implications

Our data also suggest that emotional variables are central in explaining the level of glycemic control. They appear to have a greater effect than other types of variables (such as cognitive efficiency or, to a lesser extent, problem-solving capacities). This is an important feature because interventions on emotional factors could help diabetics to follow their treatments better, adopt self-care behaviors, and so forth. Consequently, our results suggest that interventions should deal with emotional distress and feelings of uncontrollability, together with sadness and resentment. These should also favor a better expression of affect to manage a tendency to constrict affective experience that seems deleterious for long-term blood glucose control. This could be implemented through a classical expressive-supportive psychotherapy (Luborsky, 1984), behavioral interventions such as management of adherence (Dunbar-Jacob, Burke, & Puczynski, 1995), or even stress management programs (Parker, 1995).

One important question remains as to whether negative emotions are also related to other diseases whether or not they produce biological markers of the type found in diabetes. In fact, difficulties in adherence to treatment and regimen are common in most chronic conditions. It would certainly be central to try and generalize our findings in other somatic diseases. Our study could not answer this because we did not use a control group. Yet, at a clinical level we were more concerned by a strong homogeneity of the sample to permit conclusions within a diabetic sample. Generalization and cross-disease comparisons remain a perspective for further research.

Other unexpected results suggest that greater attention should be paid to the potential cost of diabetes management. Numerous clinical studies have shown that this was high for all IDDM patients (e.g., Talbot, Nouwen, Gingras, Gosselin, & Audet, 1997). Our result involving a Sum T = 0 personality stresses that this cost could be in some way higher in patients with good control of their illness than in patients with poor control. Although we do not know whether this aspect of patients' personality is a cause or a consequence of good control, this characteristic is usually taken by practitioners to be a negative facet of a Rorschach protocol. The fact that it is related to good behavioral management of the illness is in itself counterintuitive and is worthy of the attention of professionals working with IDDM patients.

ACKNOWLEDGMENTS

This study was supported in part by the Assistance Publique Hôpitaux de Paris. We thank Anne Andronikof and Andre Grimaldi for their help.

REFERENCES

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Andronikof-Sanglade, A. (1986). From child diabetes to diabetic child. *Perspectives Psychiatriques, 25,* 162–170.

Appelbom-Fondu, J., Verstraeten, F., & Dopchie, N. (1974). Psychological aspects of diabetes and its treatment in adolescence. *Revue de Neuropsychiatrie Infantile et d'Hygiene mentale de l'Enfance, 22,* 725–735.

Berlin, I., Bisserbe, J. C., Eiber, R., Balssa, N., Sachon, C., Bosquet F., et al. (1997). Phobic symptoms, particularly the fear of blood and injury, are associated with poor glycemic control in type 1 diabetic adults. *Diabetes CARE, 20,* 176–178.

Bishop, G.D. (1994). *Health psychology, integrating mind and body.* Boston: Allyn & Bacon.

Bott, S., Bott, U., Berger, M., & Mühlhauser, I. (1997). Intensified insulin therapy and the risk of severe hypoglycaemia. *Diabetologia, 40,* 926–932.

Buchwald, C., & Blatt, S. J. (1974). Personality and the experience of time. *Journal of Consulting and Clinical Psychology, 42,* 639–644.

Cox, D. J., & Gonder-Frederick, L. (1992). Major developments in behavioral diabetes research. *Journal of Consulting and Clinical Psychology, 60,* 628–638.

The Diabetes Control and Complications Trial Research Group. (1993). The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England Journal of Medicine, 329,* 977–986.

Di Iullo, M. G., Ranzini, L., & Zabattini, G. C. (1985). Diabetes during development: Influence on the personality and importance of metabolic control. *Eta Evolutiva, 21,* 45–54.

Dunbar-Jacob, J., Burke, L. E., & Puczynski, S. (1995). Clinical assessment and management of adherence to medical regimens. In P. M. Nicassio & T. W. Smith (Eds.), *Managing chronic illness* (pp. 313–350). Washington, DC: American Psychological Association.

Eells, G. T., & Boswell, D. L. (1994). Validity of Rorschach inanimate movement and diffuse shading responses as measures of frustration and anxiety. *Perceptual and Motor Skills, 78,* 1299–1302.

Exner, J. E., Jr. (1978). *The Rorschach: A comprehensive system: Vol. 2. Current research and advanced interpretation.* New York: Wiley.

Exner, J. E., Jr. (1986). *The Rorschach: A comprehensive system: Vol. 1. Basic foundations* (2nd ed.). New York: Wiley.

Exner, J. E., Jr. (1991) *The Rorschach: A comprehensive system: Vol. 2. Interpretation* (2nd ed.). New York: Wiley.

Exner, J. E., Jr., Kinder, B. N., & Curtiss, G. (1995). Reviewing basic design features. In J. E. Exner, Jr. (Ed.), *Issues and methods in Rorschach research* (pp.145–158). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Faellstroem, K., & Vegelius, J. (1978). A discriminatory analysis based on dichotomized Rorschach scores of diabetic children. *International Journal of Rehabilitation Research, 1,* 45–54.

Fisher, E. B., Delamater, A. M., Bertelson, A. D., & Kirkley, B. G. (1982). Psychological factors in diabetes and its treatment. *Journal of Consulting and Clinical Psychology, 50,* 993–1003.

Franck, G. (1993). On the validity of hypotheses derived from the Rorschach: The relationship between color and affect, update 1992. *Psychological Reports, 73,* 12–14.

Frenzel, M. P., McCaul, K. D., Glasgow, R. E., & Schafer, L. C. (1988). The relationship of stress and coping to regimen adherence and glycemic control of diabetes. *Journal of Social and Clinical Psychology, 6,* 77–87.

Gacono, C. B., & Meloy, J. R. (1991). A Rorschach investigation of attachment and anxiety in antisocial personality disorder. *Journal of Nervous and Mental Disease, 179,* 546–552.

Geringer, E., Perlmuter, L., Stern, T., & Nathan, D. (1988). Depression and diabetic neuropathy: A complex relationship. *Journal of Geriatric Psychiatry & Neurology, 1,* 11–15.

Grey, M., Boland, E. A., Davidson, M., Yu, C., Sullivan Bolyai, S., & Tamborlane, W. V. (1998). Short-term effects of coping skills training as adjunct to intensive therapy in adolescents. *Diabetes CARE, 21,* 902–908.

Grey, M., Lipman, T., Cameron, M. E., & Thurber, F. W. (1997). Coping behaviors at diagnosis and in adjustment one year later in children with diabetes. *Nursing Research, 46,* 312–317.

Hanson, C. L., Cigrang, J. A., Harris, M. A., & Carle, D. L. (1989). Coping styles in youths with insulin-dependent diabetes mellitus. *Journal of Consulting and Clinical Psychology, 57,* 644–651.

Hathaway, S. R., & McKinley, J. C. (1943). *Minnesota Multiphasic Personality Inventory.* Minneapolis: University of Minnesota Press.

Howorka, K., Pumprla, J., Wagner-Nosiska, D., Grillmayr, H., Schlusche, C., & Schabmann, A. (2000). Empowering diabetes out-patients with structured education: Short-term and long-term effects of functional insulin treatment on perceived control over diabetes. *Journal of Psychosomatic Research, 48,* 37–44.

Koch, M. F., & Molnar, G. D. (1974). Psychiatric aspects of patients with unstable diabetes mellitus. *Psychosomatic Medicine, 36,* 57–68.

Kunce, J. T., & Tamkin, A. S. (1981). Rorschach movement and color responses and the MMPI social extraversion and thinking introversion personality types. *Journal of Personality Assessment, 45,* 5–10.

Leavitt, F. (2000). Texture response patterns associated with sexual trauma of childhood and adult onset: Developmental and recovered memory implications. *Child Abuse and Neglect, 24,* 251–257.

Lebo, D., Toal, R., & Brick, H. (1960). Rorschach performances in the amelioration and continuation of observable anxiety. *Journal of General Psychology, 63,* 75–80.

Loving, J. L., Jr., & Russell, W. F. (2000). Selected Rorschach variables of psychopathic juvenile offenders. *Journal of Personality Assessment, 75,* 126–142.

Luborsky, L. (1984). *Principles of psychoanalytic psychotherapy.* New York: Basic.

Lustman, P. J., Griffith, L. S., & Clouse, R. E. (1988). Depression in adults with diabetes: Results of 5-year follow-up study. *Diabetes CARE, 11,* 605–612.

Maes, S., Leventhal, H., & De Ridder, D. T. D. (1996). Coping with chronic disease. In M. Zeidner & N. S. Endler (Eds.), *Handbook of coping* (pp. 252–278). New York: Wiley.

Marsh, A., & Viglione, D. J. (1992). A conceptual validation study of the texture response on the Rorschach. *Journal of Personality Assessment, 58,* 571–579.

McCraw, R. K., & Tuma, J. M. (1977). Rorschach content categories of juvenile diabetics. *Psychological Reports, 40,* 818.

McGowan, W., Fink, A. D., Galina, H., & Johnson, J. (1992). Effects of laboratory-induced controllable and uncontrollable stress on Rorschach variables m and Y. *Journal of Personality Assessment, 59,* 564–573.

Monedero-Gil, C., & Ruiz de Albacete, S. (1977). Psychology of the child and adolescent diabetic. *Revista de Psicologia General y Aplicada, 32,* 391–397.

Padgett, D., Mumford, E., Hynes, M., & Carter, R. (1988). Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *Journal of Clinical Epidemiology, 41,* 1007–1030.

Parker, J. C. (1995). Stress management. In P. M. Nicassio & T. W. Smith (Eds.), *Managing chronic illness* (pp. 313–350). Washington, DC: American Psychological Association.

Peyrot, M., & McMurry, J. F. (1992). Stress buffering and glycemic control. *Diabetes CARE, 15,* 842–846.

Pierce, G. E. (1978). The absent parent and the Rorschach T response. In E. J. Hunter & D. S. Nice (Eds.), *Children of military families* (pp. 57–73). Washington, DC: U.S. Government Printing Office.

Polonsky, W. H., Anderson, B. J., Lohrer, P. A., Welch, G., Jacobson, A. M., Aponte, J. E., et al. (1995). Assessment of diabetes-related distress. *Diabetes CARE, 18,* 754–760.

Schiffreen, R. S., Hickingbotham, J. M., & Brown, G. N. (1980). Accuracy, precision and stability in measurement of hemoglobin A_{1C} by high performance cation-exchange chromatography. *Clinical Chemistry, 26,* 3–8.

Schlesinger, L. B., & Fox, C. F. (1980). Achromatic Rorschach perceptions: Some implications for the diagnosis of depression. *Perceptual and Motor Skills, 50,* 199–202.

Sénécal, C., Nouwen, A., & White, D. (2000). Motivation and dietary self-care in adults with diabetes: Are self-efficacy and autonomous self-regulation complementary or competing constructs?. *Health Psychology, 19,* 452–457.

Smari, J., & Valtysdottir, H. (1997). Dispositional coping, psychological distress and disease-control in diabetes. *Personality and Individual Differences, 22,* 151–156.

Stevens, D. T., Edwards, K. J., Hunter, W. F., & Bridgman, L. (1993). An investigation of the color-affect hypothesis in Exner's Comprehensive System. *Perceptual and Motor Skills, 77,* 1347–1360.

Talbot, F., Nouwen, A., Gingras, J., Gosselin, M., & Audet, J. (1997). The assessment of diabetes-related cognitive and social factors: The Multi-Dimensional Diabetes Questionnaire. *Journal of Behavioral Medicine, 20,* 291–312.

Viglione, D. (1997). Problems in Rorschach research and what to do about them. *Journal of Personality Assessment, 68,* 590–599.

Weiner, I. B. (1998). *Principles of Rorschach interpretation.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Wing, R. R., Epstein, L. H., Nowalk, M. P., & Lamparski, D. M. (1986). Behavioral self-regulation in the treatment of patients with diabetes mellitus. *Psychological Bulletin, 99,* 78–89.

Wulsin, L. R., Jacobson, A. M., & Rand, L. I. (1987). Psychosocial aspects of diabetic retinopathy. *Diabetes CARE, 10,* 367–373.

Serge Sultan
Department of Psychology
Laboratoire de Psychologie Clinique et Sociale
University of Burgondy
36, rue Chabot-Charny
21000 Dijon, France
E-mail: serge.sultan@u-bourgogne.fr

Received March 19, 2001
Revised December 14, 2001