JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2001, **34,** 497–500 NUMBER 4 (WINTER 2001)

EXPOSURE-BASED TREATMENT TO CONTROL EXCESSIVE BLOOD GLUCOSE MONITORING

KEITH D. ALLEN AND JOSEPH H. EVANS

MUNROE-MEYER INSTITUTE FOR GENETICS AND REHABILITATION
UNIVERSITY OF NEBRASKA MEDICAL CENTER

We investigated an exposure-based procedure for reducing excessive checking of blood glucose by a child with diabetes. In a changing criterion design, an exposure-based procedure was implemented by systematically exposing the child to decreasing amounts of information about blood sugar levels (checking) and thereby increasing exposure to potential hypoglycemia. Access to information was reduced in graduated increments, with the parents setting criteria to levels at which they were willing to adhere. Results demonstrated that the procedure was effective in reducing excessive blood glucose checking and in improving metabolic control.

DESCRIPTORS: exposure-based treatment, diabetes, behavioral pediatrics, hypoglycemia, changing criterion design

The experience of hypoglycemia (i.e., low blood sugar) for children with insulin-dependent diabetes is one of most unpleasant aspects of the disease. Hypoglycemia is characterized by symptoms such as headaches, dizziness, sweating, shaking, impaired vision, and increased heart rate and can lead to seizures and loss of consciousness. Thus, children often learn that hypoglycemic episodes are physically aversive and a source of possible social embarrassment (Brouhard, 1987). Parents, who are often responsible for managing the diabetes regimen, may also have had aversive experiences watching their children experience hypoglycemic episodes. As a result, many children and their concerned parents engage in active avoidance of low blood sugar by frequently checking blood glucose (hypervigilance) and deliberately maintaining high blood glucose levels. In a classic avoidance paradigm, the behaviors that minimize the likelihood of experiencing a hypoglycemic episode (e.g., hypervigilance) are negatively reinforced (Marrero, Guare, Vandagriff, & Fineberg, 1997). The result can be poor metabolic control and increased health risk for complications such as blindness, renal failure, nerve damage, and heart disease.

The diabetes literature is replete with articles describing avoidance of hypoglycemia as a significant problem (e.g., Green, Feher, & Catalan, 2000); however, there are few, if any, studies of interventions designed to address the problem. One significant obstacle to successful treatment may be the fact that intervention requires treatment of both child avoidance and parent avoidance. Because parents often have direct control over the diabetes regimen, failure to address their avoidance behavior could corrupt treatment adherence and weaken treatment effectiveness (Allen & Warzak, 2000). In this study, we investigate an exposure-based procedure for reducing excessive blood glucose checking by a child with diabetes.

METHOD

Participant. Amy was a 15-year-old girl who had been diagnosed with insulin-

This research was supported in part by Grant MCJ 319152 from the Maternal and Child Health Bureau, Health Resources Services Administration, and by Grant 90 DD 032402 of the Administration on Developmental Disabilities.

Correspondence may be addressed to Keith D. Allen, Munroe-Meyer Institute, 985450 Nebraska Medical Center, Omaha, Nebraska 68198-5450.

dependent diabetes approximately 2 years previously. She had no significant developmental problems and was an excellent student. Her parents were actively involved in her diabetes management, including checking of blood sugar levels and assisting with insulin injections at home. At school, Amy was independent in monitoring blood glucose levels. Amy had been asked by her endocrinologist to maintain good metabolic control by keeping her blood sugar levels between 75 and 150 mg/dl. This required conducting regular checks of her blood sugar using a blood glucose monitor (BGM) 6 to 12 times per day, depending upon her meals, exercise, stress, and evidence of hypoglycemic symptoms. A single hypoglycemic episode reportedly occurred soon after diagnosis, during which blood glucose levels fell to 40 mg/dl, resulting in significant physical symptoms but no loss of consciousness. The frequency of monitoring had gradually increased and, at the time of referral, Amy was reportedly checking blood glucose levels from 80 to 90 times per day, costing the parents about $600 per week in reagent test strips. In addition, blood glucose levels were being maintained well above the recommended range (75 to 150 mg/dl), reflecting poor metabolic control (275 to 300 mg/dl).

Response measurement. Blood glucose monitoring was conducted using a pocket-sized Precision Q-I-D BGM. Patients produce a blood sample with a finger prick, apply the sample to a reagent test strip, insert the test strip into the monitor, and receive a digital display of the current blood glucose level. Up to 100 separate checks are stored in the monitor and can be downloaded for later analysis, showing the exact date and time of each check. Thus, the monitor provides specific data regarding the number of checks each day and the blood glucose level at each of those checks.

Procedure and design. In a changing criterion design, Amy's parents gradually reduced access to BGM test strips, exposing both Amy and her parents to a decreasing frequency of information about blood glucose level. The parents expressed fears, however, that regardless of the criterion level, Amy might encounter a situation in which additional checking would be necessary. Concerns about adherence to the exposure protocol by the parents resulted in a graduated protocol in which Amy could earn a small number of additional test strips above and beyond the limit set by the parents. One additional test strip could be earned for each half hour of engagement in household chores. Amy was allowed to earn a maximum of five additional tests above the criterion when the criterion was set at 20 test strips or higher. Amy was allowed two additional test strips when the criterion was set below 20. Access to test strips was reduced in graduated increments, with the parents setting criteria to levels at which they were willing to adhere. Criteria changes were contingent upon Amy successfully reducing total test strip use to below the criterion on 3 successive days.

RESULTS AND DISCUSSION

Figure 1 shows the last 10 data points from each criterion level for BGM checks. Figure 1 shows that, during baseline, checks were occurring from 80 to 95 times per day. The parents selected 60 test strips as the initial criterion and dropped the criterion in 20-check increments until Amy was conducting 20 total checks; then the parents elected to drop criteria in two-check increments. Because the parents provided only the number of strips indicated by the criterion, any checking over the established criterion reflected additional test strips earned by Amy. Over a 9-month period, Amy gradually dropped her use of test strips from over 80 to less than 12 per day. At 3-month follow-up, checks were at or below 12 per day

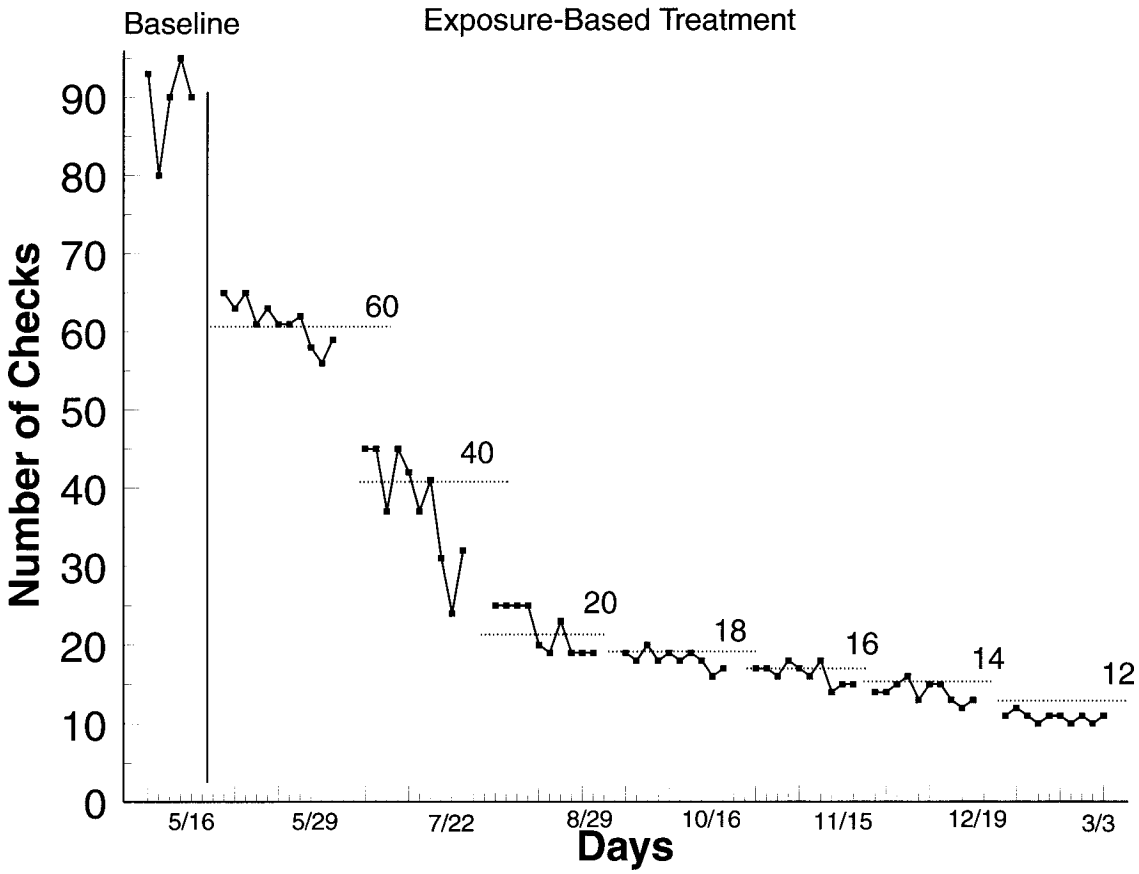

Figure 1. Number of blood glucose monitoring checks conducted during the last 10 days at each criterion level. Maximum test strips allotted at each level are indicated by dashed lines and corresponding numbers. The number of checks above the established criterion level reflect the number of additional test strips earned by Amy. Complete data from testing during the intervention are available from the authors.

and blood glucose levels were at or near the target range. The parents reported that they did not intend to drop the criterion any lower.

One concern during treatment was that Amy might respond to the decreasing amount of information about blood glucose levels by maintaining high blood glucose levels. Blood glucose levels in baseline were well above the target range of 75 to 150 mg/dl (range, 275 to 300 mg/dl). During treatment, blood glucose levels initially increased, but gradually decreased over the 9-month intervention to at or near target levels (range, 125 to 175 mg/dl).

These data demonstrate that an exposure-based procedure can be an effective means of reducing excessive blood glucose checking and improve metabolic control as well. These data are consistent with past observations that avoidance behaviors are closely associated with poor metabolic control. In this case, metabolic control showed marked improvements, although only the excessive checking was targeted for change. These data have significant implications for diabetes management when avoidance of hypoglycemia and resulting poor metabolic control are frequent problems. Having interventions that can help bring blood glucose levels to the near-normal range can prevent, delay, or minimize serious complications of diabe-

tes such as blindness, renal failure, nerve damage, and heart disease.

The results of this investigation also show that avoidance behaviors in both children and parents can be addressed simultaneously. In effect, both Amy and her parents were undergoing exposure treatment. That is, both were exposed to decreasing amounts of information and increased risk of hypoglycemia. Because the parents were permitted to regulate the extent of each criterion change, the intervention was quite lengthy. However, by allowing the parents to adjust their own exposure to acceptable levels, adherence to the overall procedure may have been improved.

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Received April 23, 2001
Final acceptance August 18, 2001
Action Editor, Linda Cooper-Brown