Frequency of Diet and Physical Activity Goal Attainment and Barriers Encountered Among Adults With Type 2 Diabetes During a Telephone Coaching Intervention

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■ **IN BRIEF** Participants with type 2 diabetes established personalized dietary and physical activity goals as behavioral strategies to reduce cardiovascular risk during a 16-week telephone coaching intervention. People were most likely to attain dietary goals that involved altering the intake of specific foods rather than certain nutrients and were more successful at physical activity goals to increase activity levels rather than to add new types of activity. Barriers to goal success included time management, physical limitations/illness, and social/cultural activities.

People with type 2 diabetes are encouraged to optimize dietary patterns and engage in regular physical activity (PA) to reduce their risk for cardiovascular disease (CVD) and related comorbidities. Lifestyle interventions and diabetes self-management education programs for people with type 2 diabetes have achieved moderate success (1–3), as people often achieve some behavioral goals. However, the extent of concordance of behavior-change activities with personal preferences and the specific approaches implemented to achieve behavior change may account for some of the variability in intervention outcomes. Mixed study results support examining people's choices about types of dietary and PA behavior changes in relation to the extent of behavior-change success to achieve risk factor reduction.

Goal-setting is often used in diabetes self-management education for long-term disease management (3,4). Specific, challenging goals lead to greater likelihood of performance of a target behavior than do easy or vague goals, which over time may lead to greater behavioral change (5). One practical strategy for goal-setting is the establishment of "SMART" (Specific, Measurable, Achievable, Realistic, and Time-bound) goals (6). Whether individuals are more successful at changing diet and PA simultaneously or targeting one behavior at a time remains controversial. Coaction of behaviors may produce greater change, but single behavior changes may promote greater mastery and habit formation (7).

Patients report greater satisfaction with health care when they participate in the decision-making process with health care providers to make choices consistent with their personal values and preferences (8,9). Among people with diabetes, however, controversy exists regarding whether goals should be self-set, collaboratively set, or prescribed (10,11). For example, clinical practice recommendations often prescribe specific behavioral goals (e.g., engage in ≥150 minutes/week of moderate- to vigorous-intensity PA spread over ≥3 days/week with ≤2 consecutive days without activity) (12). Yet, these recommendations may not be compatible with an individual's personal goals or ability. Also, people experience multiple barriers to optimally

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self-managed dietary and PA behaviors (13), highlighting a need for tailored behavioral coaching.

The types of goals people choose to achieve success are under-reported for many intervention studies. As a basis for a larger-scale intervention trial, the purpose of this pilot study was to evaluate a telephone-based goal-setting and decision-support coaching intervention among adults with type 2 diabetes to examine the type, frequency, and success rates of self-set dietary or meal planning and PA behavioral goals. The research questions included: *1*) What are the types of dietary and PA goals selected, and how frequently is each goal type selected and attained? *2*) How frequently and for how long do participants maintain a goal after attaining it the first time? and *3*) What are common barriers to attaining self-set dietary and PA goals? Answers to these questions will assist practitioners in identifying and tailoring goals for successful diabetes self-management.

Methods

Study Population and Recruitment

Participants were recruited from a metropolitan community in the midwestern United States by advertisements in online newsletters, flyers distributed to community organizations (e.g., libraries), and the ResearchMatch research volunteer database. Inclusion criteria were designed to recruit a diverse sample with diabetes at elevated risk for CVD. Participants were required to be overweight or obese, 40–75 years of age, diagnosed with type 2 diabetes for ≥1 year, and have ≥1 additional risk factor for CVD, including an elevated blood pressure, lipid, or A1C level (14,15). Exclusion criteria were type 1 or gestational diabetes; pregnancy, trying to become pregnant, or lactating; BMI >50 kg/m², other medical concerns requiring dietary treatment; inability to perform PA without a physician's recommendation; or possible untreated clinically

significant depression (score ≥10 on the Patient Health Questionnaire-8) (16). The sponsoring university's institutional review board approved the study, and participants provided written informed consent.

Study Design

The parent study employed a randomized pre-/post-test control group design to evaluate the impact of the telephone coaching intervention on clinical and behavioral outcomes between treatment groups, and its results have been reported elsewhere (17). Control group participants did not receive telephone coaching or set behavioral goals; thus, only data from the intervention groups at baseline and after the coaching calls were used for the present analyses. Previous reports did not present findings regarding goals selected or success in goal attainment, which is crucial to program evaluation.

Interested individuals completed a screening telephone interview, and a screening appointment was scheduled with potentially eligible participants. Written informed consent was obtained at the in-person screening visit, and clinical measures were assessed to confirm eligibility. Eligible and enrolled participants received personalized information about their CVD risk factors and behavior-change strategies to reduce risk. Participants then were randomized to one of three study arms: multiple-goal (MG) intervention, single-goal (SG) intervention, or attention control group.

Treatment Groups

Intervention participants received one in-person goal-setting and decision-support coaching session to encourage lifestyle change. Tailored, self-set goals and action plans pertaining to diet and/or PA were established using a motivational interviewing approach. The intervention did not assign concrete behavior goals; instead, participants were guided toward making goals consistent with their preferences and CVD risk factors and instructed

to set SMART goals and action plans to facilitate goal achievement. A decision-support coaching protocol was used to assist with clarifying personal preferences and working through decisional conflict for self-management options. Problem-solving occurred to identify strategies to minimize potential barriers to goal attainment.

Participants in the MG group established one dietary and one PA goal during the first session and subsequently discussed their goals in both domains during every coaching call, altering or setting new goals in both domains as needed. Those in the SG group set one goal for either a diet- or PA-related behavior during the first session based on individual preference. SG group members were instructed to only set a new goal or alter an existing goal after goal attainment for one behavioral domain at a time at each subsequent coaching call. Suggestions were provided, if requested, that were consistent with type 2 diabetes clinical practice recommendations (12).

Participants subsequently received decision-support telephone coaching biweekly (i.e., every 2 weeks) after the initial in-person visit for an additional seven contacts. Telephone calls were initiated by the interventionist at an agreed upon day and time. During each call, the participant and interventionist discussed the participant's extent of success with self-set goals and created new or modified existing goals. A new goal was established after attainment of an existing goal. If a goal was not achieved, problem-solving for minimizing barriers toward goal attainment occurred or an alternate goal was established, supported by decision coaching to clarify preferences and work through decisional conflict, as relevant. Descriptions of goals and action plans were recorded and emailed to participants within 1 hour after each coaching session.

Data Analyses

Detailed narrative notes were written by the interventionist after the in-

TABLE 1. Characteristics of Participants in a Telephone Coaching Intervention Randomized to the MG or SG Treatment Group

	MG Group (n = 19)	SG Group (n = 18)	P*
Age (years; mean [SD])	56.26 (8.12)	57.28 (6.40)	0.68
Diagnosed with diabetes (years; mean [SD])†	8.63 (6.08)	7.88 (5.63)	0.71
	n (%)	n (%)	P‡
Race			
Caucasian	15 (78.95)	14 (77.78)	0.93
African American	4 (21.05)	4 (22.22)	
Sex			
Male	6 (31.58)	6 (33.33)	0.91
Female	13 (68.42)	12 (66.67)	
Education			
High school diploma	1 (5.26)	3 (16.67)	
Some college	4 (21.05)	4 (22.22)	0.70
Bachelor's degree	8 (42.11)	7 (38.89)	
Advanced degree	6 (31.58)	4 (22.22)	
Employment			
Full-time	12 (63.16)	9 (50.00)	
Part-time	0 (0.00)	3 (16.67)	0.14
Work and in school	2 (10.53)	0 (0.00)	
Retired or disabled	5 (26.32)	6 (33.33)	
Marital status			
Single or widowed	6 (31.58)	7 (38.89)	0.64
Married or living with partner	13 (68.42)	11 (61.11)	
Income§			
<$20,000	2 (11.11)	3 (16.67)	
$20,000–59,999	4 (22.22)	4 (22.22)	0.42
$60,000–99,999	6 (33.33)	9 (50.00)	
≥$100,000	6 (33.33)	2 (11.11)	
Baseline risk factors			
A1C ≥6.5%	13 (68.42)	15 (83.33)	0.29
Total cholesterol ≥200 mg/dL	8 (42.11)	4 (22.22)	0.20
LDL cholesterol ≥100 mg/dL‖	6 (35.29)	5 (27.78)	0.63
Triglycerides ≥150 mg/dL	14 (73.68)	12 (66.67)	0.64
Systolic blood pressure ≥130 mmHg	11 (57.89)	8 (44.44)	0.41
Diastolic blood pressure ≥80 mmHg	15 (78.95)	16 (88.89)	0.41

*Independent t test of between-group differences of group means.
†Two people in the SG group did not provide this information.
‡Pearson χ^2 test of between-group differences.
§One person in the MG group did not provide this information.
‖Two values were missing from the MG group because of an omission of LDL cholesterol calculation when triglycerides were >400 mg/dL.

person (week 0) and telephone (weeks 2–14) coaching sessions to record new goals established, dietary and PA behaviors reported during the previous 2 weeks, degree of goal attainment, and personal, social, and environmental factors encountered that influenced goal attempts. The types of goals established, degree of goal

attainment, and types and frequency of barriers reported were coded based on the narrative notes. Goals were categorized into different goal types for analysis. The frequency of each person's goal attempts for both diet and PA goals biweekly was recorded and coded on an ordinal scale, in which 0 = goal never attempted, 1 = goal attempted less than half the time, 2 = goal attempted half the time or more but not fully attained, 3 = goal attained as stated, and 4 = goal behavior performed more than stated. Average goal attainment was obtained by summing the 0–4 values for each time period a goal type was attempted and dividing by the number of time periods that goal type was attempted.

In addition, a list of common barriers encountered during lifestyle change was developed at baseline based on previous research (18), with additional barriers added as needed during the study. The presence or absence of each barrier type encountered in every biweekly period by participants in the current study was recorded as a binary variable. Two independent observers coded the narrative notes using the study codebook to calculate interrater reliability of the codes established for all goal type, attainment, and barrier codes. Cohen's κ, an interrater reliability coefficient that corrects for chance agreement, ranged between 0.70 and 1.00 for all goal and barrier variables.

To address the types and frequencies of self-set goals established and attained (research question 1), one-way analysis of variance (ANOVA) compared differences in average goal attainment for dietary and PA behaviors by goal type. The number of goals attempted during at least three biweekly periods and attained during at least 1 biweekly period was analyzed (research question 2). Subsequently, the percentage of goals attained at least once after the first attainment was calculated. Among goals attempted for ≥3 biweekly periods, the mean number of weeks goals were attained was calculated as

a proxy for goal maintenance. Goals that were never attained despite being attempted during ≥3 biweekly periods were not included in the goal maintenance analysis.

The number of times each barrier to goal attainment was discussed by participants was quantified (research question 3). Repeated-measures ANOVA assessed the change in frequency of reported barriers over time. χ^2 testing assessed differences in total frequency of barrier types between intervention groups. Statistical significance was set at $P \leq 0.05$, and analyses were conducted using SPSS version 22.0 (IBM Corp., Armonk, N.Y.).

Results

Study Sample

One hundred forty-seven adults inquired about the study, 119 completed telephone screening, 63 completed in-person screening, and 60 eligible participants consented to study participation. Thirty-seven participants were randomized to the MG and SG groups used for the reported analyses. There were no significant differences in demographic or clinical characteristics at baseline between the MG and SG groups (all $P > 0.05$; Table 1).

Most Frequently Established and Attained Dietary and PA Goals

Table 2 shows the goal types and the number of times each type was established by participants. Increasing the frequency of consumption of a healthy food (e.g., vegetables) and decreasing the frequency of consumption of a less healthy food (e.g., fried foods) were the two most frequently self-selected dietary goals. There was a significant difference in dietary goal attainment by goal type ($P < 0.001$). The dietary goals attained most frequently included eating out less frequently, reducing or removing a food from the diet, and adding or increasing a food in the diet.

The PA goal established most frequently was adding a new type of activity; there was a significant

difference in PA goal attainment by goal type ($P = 0.005$). PA goals most frequently attained included adding exercise occasions and adding minutes/miles/steps per occasion. There were no significant differences between the MG and SG groups for types of goals set or attained; thus, Table 2 presents combined findings for both groups.

Goal Maintenance for Self-Selected Behaviors

Of dietary goals that were selected for ≥3 biweekly periods, 88.3% were attained at least once after the first attainment (data not shown). These dietary goals were pursued an average of 10.3 weeks and were attained during 7.5 of those weeks.

PA goals that were selected for ≥3 biweekly periods were attained at least once after initial attainment 72.5% of the time. These goals were pursued for 11.1 weeks and attained during 5.6 of those weeks on average. There were no significant differences between the MG and SG groups for goal maintenance variables.

Barriers to Goal Attainment

The number of diet-related barriers reported was significantly different between groups ($P = 0.03$); the MG group reported more barriers than the SG group (Table 3). The MG group was more likely than the SG group to report a temporary lapse in motivation or self-control for meal planning ($P = 0.04$) and more likely to report limited interest in initiating a new behavior for both diet ($P = 0.03$) and PA ($P = 0.005$). The number of PA barriers reported was higher in the MG group, but the difference was not statistically significant ($P = 0.06$). There was a significant effect of time for the mean number of PA barriers reported during the 14 weeks ($P = 0.03$), but no group or interaction effects were observed (data not shown).

Discussion

This study is among the first to describe the type and frequency of diet- and PA-related goals established by

TABLE 2. Dietary and PA Goal Types and Level of Attainment Among Adults With Type 2 Diabetes Enrolled in a Telephone Coaching Intervention (*n* = 37)

	Goal Attempts (*n* [%])	Average Attainment (range 0–4)*
Dietary goal types		
Adding/increasing healthy food in diet (e.g., vegetables, fish)	129 (26.4)	2.70
Reducing/removing less healthy food in diet (e.g., fried foods)	91 (18.6)	2.81
Adding/scheduling eating occasions	86 (17.6)	2.51
Limiting energy or nutrient intake	44 (9.0)	2.50
Self-monitoring intake (e.g., keeping food journal)	38 (7.8)	2.08
Eating out less frequently	28 (5.7)	2.86
Monitoring blood glucose postprandially	19 (3.9)	2.63
Substituting healthier foods (e.g., whole vs. refined grains)	18 (3.7)	2.56
Increasing nutrient intake (e.g., fiber)	18 (3.7)	2.11
Subtracting eating occasions (e.g., omitting eating after 7:00 p.m.)	13 (2.7)	1.31
Reducing food portions	5 (1.0)	1.80
Total	489	
PA goal types		
Adding new type of PA	197 (53.4)	2.00
Adding occasions of PA per week	63 (17.1)	2.33
Adding minutes/miles/steps per occasion	46 (12.5)	2.50
Subtracting occasions of PA per week	37 (10.0)	2.27
Subtracting minutes/miles/steps per occasion	18 (4.9)	1.33
Self-monitoring/maximizing steps or activity	8 (2.2)	1.63
Total	369	

*Average attainment was calculated by adding scores from all attempts of that goal type by all participants divided by number of occasions attempted, on a 0–4 scale in which 0 = goal not attempted, 1 = goal attempted less than half the time, 2 = goal attempted half or more but not attained, 3 = goal attained number of times stated, and 4 = goal attained more than stated.

participants with type 2 diabetes to reduce risk for CVD. Few previous studies have examined in depth the goals people self-select, their success with goal attainment, or how long goal-striving occurs. Previous research found that dietary goals were the most frequent type of goal chosen by diabetes patients in a clinical setting (4). When participants in the current pilot study were encouraged to self-set dietary goals for the next 2 weeks, increasing and decreasing intake of specific foods were the most frequently selected behaviors. Goal attainment was greatest for eating out less frequently and for eating more or less of specific foods. Goals to subtract eating occasions, reduce the quanti-

ty of food portions, or self-monitor dietary intake or glucose values were less likely to be attained.

Previous research suggests that goal specificity is positively associated with goal attainment (19). Setting a goal to avoid a behavior, such as to forgo a snack at a certain time, may not be well defined to promote success. Evidence suggests that people tend to be more successful with "approach" goals rather than "avoidance" goals (20). Setting a goal to dine out less frequently could be posed as an approach goal by identifying an alternate approach behavior (e.g., bring lunch to work on Monday). Similarly, previous research found that people were more likely

to attain goals to increase fruit and vegetable intake (approach goal) than to decrease fat intake (avoidance goal) (21). Increasing fruit and vegetable consumption could promote a reduction in fat intake, even when fat-related goals are not specifically selected, if specific strategies for making substitutions are identified. Nutrition therapy recommendations for type 2 diabetes acknowledge that a variety of eating patterns are acceptable but provide primarily nutrient-based recommendations (22). Translating nutrient goals into food-based approaches through medical nutrition therapy is likely needed for many people to realize their dietary goals.

Although attainment of different

TABLE 3. Type and Frequency of Diet- and PA-Related Barriers to Goal Attainment Reported by Participants by Treatment Group

	MG Group (n = 19) (n [%])	SG Group (n = 18) (n [%])	P*
Diet-related barriers			
Time management	20 (27.0)	13 (27.1)	0.24
Vacation or holiday	7 (9.5)	8 (16.7)	0.73
Short-term illness	6 (8.1)	5 (10.4)	0.81
Feeling overwhelmed or stressed	7 (9.5)	4 (8.3)	0.39
Limited family or home support	6 (8.1)	3 (6.3)	0.34
Major life event (e.g., death in family)	4 (5.4)	5 (10.4)	0.69
Temporary lapse in motivation or self-control	7 (9.5)	1 (2.1)	0.04
Limited environmental resources (e.g., poor food options near place of employment)	2 (2.7)	4 (8.3)	0.38
Limited social support	4 (5.4)	2 (4.2)	0.44
Limited financial resources	2 (2.7)	3 (6.3)	0.62
Limited interest in new behavior (e.g., packing lunch)	5 (6.8)	0 (0.0)	0.03
Limited knowledge regarding optimal food choices	3 (4.1)	0 (0.0)	0.09
Physical limitation for food preparation (e.g., arthritis)	1 (1.4)	0 (0.0)	0.32
Total	74	48	0.03
PA-related barriers			
Time management	30 (27.8)	28 (35.4)	0.90
Physical limitation (e.g., muscle soreness, arthritis)	15 (13.9)	9 (11.4)	0.24
Short-term illness	9 (8.3)	8 (10.1)	0.87
Vacation or holiday	7 (6.5)	6 (7.6)	0.83
Feeling overwhelmed or stressed	10 (9.3)	3 (3.8)	0.06
Inclement weather	9 (8.3)	4 (5.1)	0.18
Limited environmental resources (e.g., no exercise facility near work or home)	7 (6.5)	6 (7.6)	0.83
Major life event (e.g., divorce, death in family)	4 (3.7)	5 (6.3)	0.69
Limited interest in new behavior (e.g., disliked weight lifting)	8 (7.4)	0 (0.0)	0.005
Limited financial resources (e.g., for exercise facility membership fee)	1 (0.9)	5 (6.3)	0.09
Limited family/home support	4 (3.7)	1 (1.3)	0.19
Temporary lapse in motivation or self-control	3 (2.8)	1 (1.3)	0.33
Limited social support	0 (0.0)	3 (3.8)	0.08
Lack of information	1 (0.9)	0 (0.0)	0.33
Total	108	79	0.06

Pearson χ^2 test of between-group differences.

types of dietary goals varied, there was no difference in the types of goals maintained over time. Maintained dietary goals were pursued for 10 weeks on average; however, this analysis did not account for goals attempted during only one or two biweekly periods and then abandoned. People may initiate dietary change by selecting dietary behaviors that are fairly easy to achieve, and this strategy enhances self-efficacy. Over time, as the behavior change process continues, progressively more difficult behaviors remain, goal difficulty increases, and the difficulty of specific behaviors becomes individually variable. Goal-setting theory asserts

that difficult goals lead to higher performance until goals are perceived to be too difficult (23). As participants established self-set goals, easy to moderately difficult goals may have been selected throughout the study to support goal attainment. Future research is needed to determine the threshold for goal difficulty depending on the specific behavior targeted and individual characteristics. For example, is it reasonable to encourage people to consume 20 g/day of dietary fiber, whereas 30 g/day may be perceived to be too difficult and abandoned before it is even attempted? If so, for which individuals is this true?

Regular PA also is recommended for people with diabetes (12). The most frequently established PA goals in the current study included adding a new activity or increasing the frequency or duration of PA (Table 2). After goal attainment, people established more challenging goals by adding a new type of PA (e.g., cycling) or increasing the frequency or duration of PA in an existing goal (e.g., walking more).

Similar to the results observed with dietary goals, goal attainment varied across different kinds of PA goals. The most successful goals included increasing either the frequency or the duration of PA. It is likely easier to increase frequency or duration once the behavior of becoming physically active is established. Goals to reduce PA frequency (e.g., reduce walking from 7 to 5 days/week) or duration (e.g., walk 40 instead of 60 minutes) in this study often were established when participants were unsuccessful. Failing to attain goals can lower self-efficacy and goal commitment (24). Therefore, it is important to help individuals establish and advance PA goals at an appropriate level of difficulty, which includes consideration of the appropriate behavior at the appropriate frequency, duration, and intensity for each exercise session. A recent meta-analysis found that PA goal-setting interventions had larger effects when directed toward achieving moderate-intensity, rather than high-intensity, PA, especially when a majority of participants were insufficiently active at baseline (25). Additionally, goal-setting interventions were more effective when goals were set in relation to daily PA or a combination of daily and weekly PA.

Multiple barriers to behavioral change were encountered throughout the study. The MG group reported more barriers to changing both diet and PA, as expected when attempting multiple behavioral goals. Participants who expressed a lapse in motivation often reported encountering a craving for a favorite food or an eating temptation that threatened their resolve to change. Others established a goal for a new type of PA or eating behavior but reported disinterest in continuing after an attempt (e.g., one participant set a goal to ride an exercise bike and disliked feeling out of breath). In contrast, the SG group established goals in the behavioral domain that was consistent with their preferences during each coaching session. Thus, changing one behavioral domain at a time was less prone to barriers and may foster continued engagement in that behavior. A future study with a longer follow-up period is needed to evaluate the impact of single behavior changes on behavior maintenance and to determine whether certain behaviors are more easily maintained.

Multiple barriers also occurred when participants attempted diet-related changes. The most common dietary barriers reported included time management and the occurrence of vacations, holidays, or illness, which interfered with meal planning and preparation and resulted in reliance on convenience foods. Previous research found that the most commonly reported barriers to dietary adherence in diabetes management included food costs, limited knowledge, difficulty resisting food temptations, negotiating food choices with family members or in social situations, and stress (26,27).

Similarly, previous research found that only 25% of diabetes patients ≥65 years of age in the United States met PA recommendations (28). Time management, physical limitations, and short-term illness were commonly reported barriers to PA in the current study. Limited time and physical discomfort with exercise were commonly reported barriers previously (29). These personal, social, and cultural factors can interfere with even the best intentions, especially when attempting multiple behavior changes. Given the number and types of barriers possible, individualized, tailored action plans are necessary to encourage success in initiating and maintaining goal-striving and to plan ahead for the inevitable barriers that arise.

The focus on self-set SMART goals to support goal attainment, an approach similar to clinical practice, was a strength of this pilot study. Creation of action plans encouraged proactive consideration of barriers before goal attempts. Motivational interviewing through telephone coaching reduced time and travel barriers for intervention delivery.

Despite these study strengths, some limitations exist. The findings are based on a small, mostly white sample, and goal attainment was assessed through self-report. Participants may have exaggerated dietary and PA changes for social desirability; however, this effect is less likely because barriers were frequently discussed by participants. Participants in the MG group were encouraged to set goals for both diet and PA, which increased the total number of goals established. Participants may have set goals for behaviors they did not wish to change or set more goals than they would choose to set on their own.

Practice Implications
Self-selected dietary and PA goals can target diabetes self-management behaviors in need of change after identification of CVD risks, and patients do not have to rely on goals prescribed by health care providers. A 2-week

timeframe for goal pursuit provides sufficient time for people to attempt to achieve established, proximal goals. Food-based goals framed as approach goals may be more practical than nutrient-based goals. Once engagement in PA is established, setting an appropriately difficult goal regarding frequency, duration, and intensity of PA is recommended.

Practitioners could use telephone-based goal-setting with decision-support coaching in the context of long-term management of chronic diseases such as type 2 diabetes to facilitate patients' active involvement in their own care by establishing personalized behavioral goals that are specific and attainable in a manner tailored to their lifestyle. The review and discussion of goal attempts that occurs during motivational interviewing may be a key factor in modifying goals to foster incremental goal difficulty and greater goal attainment.

Duality of Interest

Author Contributions

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