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Familial Similarities of Changes in Cognitive, Behavioral, and Physiological Variables in a Cardiovascular Health Promotion Program[1]

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A number of studies have demonstrated that physiological and behavioral cardiovascular disease (CVD) risk factors aggregate within families. This fact, and the potential mediating role that the family plays in behavior change, have led to the development of family-based CVD risk reduction programs, including the San Diego Family Health Project. The aggregation of behavioral, physiological, and cognitive changes within families was assessed during a 1-year intervention. We found evidence of modest but significant aggregation of change. There was more aggregation of change in behavioral variables than in physiological or cognitive variables. More significant correlations were found among 3-day food record measures than among 24-hour recall dietary measures, suggesting an influence of assessment method. Aggregation of change within families was stronger within generations than across generations. These data point to the importance of involving all age groups in health promotion programs.

KEY WORDS: families; diet; physical activity; blood pressure; cholesterol; prevention.

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The role of the family as a mediator of health-related behaviors, such as dietary and physical activity patterns, appears to be important and long-lasting (Baranowski & Nader, 1985; Sallis & Nader, 1988). Dietary habits (Eastwood, Brydon, Smith, & Smith, 1982; Patterson, Rupp, Sallis, Atkins, & Nader, 1988) and physical activity habits (Gottlieb & Chen, 1985; Sallis, Patterson, Buono, Atkins, & Nader, 1988), as well as related physiological variables such as blood pressure (Feinleib, Garrison, & Havlik, 1980; Patterson, Kaplan, Sallis, & Nader, 1987), serum lipoproteins (Karlin et al., 1982; Morrison, Namboodiri, Green, Martin, & Glueck, 1983), and obesity (Charney, Goodman, McBride, Lyon, & Pratt, 1976; Garn & Clark, 1976; Patterson, Sallis, Kaplan, & Nader, in press) aggregate to varying degrees within families. These observations have stimulated the development of health behavior change interventions that target entire families.

Several mechanisms of family influence are available for alteration in family-based interventions. There is evidence that parental control of environmental variables (e.g., availability of foods in the home) (Birch & Marlin, 1982), parental modeling of health behaviors (Gottlieb & Chen, 1985; Harper & Sanders, 1975), and direct parental instructional prompts (Klesges, Malott, Boschee, & Weber, 1986) are effective in altering child health behaviors. These powerful mechanisms may account for the relative success of family-based health behavior change interventions (Farris, Frank, Webber, & Berenson, 1985; Kirks & Hughes, 1986; Nader, Baranowski, Vanderpool, Dworkin, & Dunn, 1983), and weight-loss programs that target children and parents (Brownell, Kelman, & Stunkard, 1983; Epstein, Koeske, Wing, & Valoski, 1986; Epstein, Nudelman, & Wing, 1987; Epstein, Wing, Koeske, Andrasik, & Ossip, 1981; Israel & Saccone, 1979; Israel, Stolmaker, Sharp, Silverman, & Simon, 1984).

In at least one weight-loss program, short-term weight losses were highly correlated between parents and children (Epstein et al., 1981). Long-term (5-year) effects of a family-based obesity treatment were found to generalize to nonparticipating obese children (Epstein et al., 1987). These results indicate that, at least in obesity treatment programs, family members tend to make similar changes. However, health promotion programs target cognitive, behavioral, and physiological changes, and it is important to explore the extent of family aggregation of changes in all these dimensions in response to family-based interventions. Family interventions are based on the belief that families influence one another (Sallis & Nader, 1988), and this should be evidenced by family aggregation of changes. However, this intrafamily influence has rarely been examined. It is hypothesized that families will be similar in their responses to family-based interventions. Findings of familial aggregation of change would support the rationale for continuing to develop family-based health promotion programs. Cognitive, behavioral, and physiological changes during a 1-year intervention were studied in Mexican-American and non-Hispanic white families (referred to as Anglo). Similarities were explored in spouse, mother–child, father–child, and sibling pairs so that the specific patterns of aggregation within families can be described.

METHODS

Subjects

For purposes of this project, family was defined as at least one adult and one child sharing usual household functions. Families of fifth- and sixth-grade children were recruited from elementary schools in the San Diego Unified School District. Census tract data were used to identify schools with large numbers of Mexican-American or Anglo families of lower to middle socioeconomic status (SES). The Hollingshead (1965) two-factor index of social position indicated that the participants ranged from middle class to the lower part of the SES distribution ($M = 2.8$, $SD = 1.2$). Families were excluded from participation if there was evidence of preexisting cardiovascular disease, total cholesterol above the 95th percentile for that age and sex, an indication of high blood pressure (defined in adults as taking blood pressure (BP) medications or, either a mean of three BP determinations of 150 mm Hg systolic or 95 mm Hg diastolic; in children either reading above the 95th percentile for that age and sex), or some chronic illness that would prohibit an individual from participating in the exercise/diet program promoted in the San Diego Family Health Project (Nader et al., 1986). Families who volunteered to participate were very similar on demographic variables and health habits to nonparticipants at the same schools (Atkins et al., 1987).

A total of 206 families (95 Anglo and 111 Mexican-American families) were recruited into the study. Approximately one half ($n = 101$) of the families were assigned randomly to participate in a cardiovascular health intervention described below. The remaining 105 families were assigned to a no-treatment control condition. Since the focus of this paper was on aggregation of change in families exposed to a health behavior change intervention, the control families were excluded from the analyses.

A total of 90 intervention families (42 Anglo and 48 Mexican-American families) were measured at baseline and 1 year, the completion of the intervention (i.e., 89% of the original families). For this analysis we combined data from both ethnic groups. Descriptive data regarding selected subject characteristics are presented in Table I. Additional subject data on the total subject population can be found elsewhere (Nader et al., 1986).

Intervention Program

The San Diego Family Health Project intervention was based on social learning theory (Bandura, 1977) and was designed to assist families in making long-term changes in their physical activity and dietary behaviors (i.e., reduce sodium and saturated fat intake and increase aerobic activity). The 1-year intervention was structured into 12 weeks of intensive intervention followed by six maintenance sessions distributed over a 9-month period. Ethnically homogeneous groups of families attended evening meetings for 90 minutes of training in self-monitoring, setting realistic goals, problem-solving, self-rewarding goal achievement, and supporting family and group members. The intervention groups were structured to maximize cultural, group, and family support for behavioral change, experiential learning, and intrinsic enjoyment of health behaviors. The intervention was conducted in Spanish and was culturally adapted for the Mexican-American families.

Intervention sessions were conducted at area schools and each session consisted of four parts. First, there was an aerobic exercise session with proper warm-up and cool-down. Then separate adult and child education segments provided new information and skills each sesion. Next, during the behavior management segment, families discussed progress and problems, set short-term goals, and adjusted personal behavior change programs. The final segment of each session was a heart-healthy snack that was prepared by a different family each week. The first session was introductory and included training in self-monitoring. Sessions 2 through 4 focused on physical activity; 5 through 7 covered sodium intake; and 8 through 10 concentrated on saturated and total fat intake. Session 11 reviewed and integrated all areas. Session 12 was a heart-healthy potluck dinner celebrating "graduation" from the intensive intervention. Maintenance sessions covered behavior chaining, ordering in restaurants, grocery shopping, resisting peer pressure, and planned and unplanned breaks in exercise and dietary routines.

Each participant maintained a notebook containing instructional materials, self-monitoring forms, and recipes. Additional materials including posters, games, role-playing situations, and slide shows were developed by a team of psychologists, health educators, a dietitian, and an exercise physiologist.

Measurement Procedures

Baseline measures were collected between October 1984 and February 1985. Follow-up measures were completed immediately after the 1 year intervention; between October 1985 and February 1986. Up to four family members were measured by staff who were trained, certified, and periodically monitored to ensure that standardized protocols were followed.

Assessment Procedures

Dietary Behavior

Collection of nutritional intake data was accomplished by three methods: a 24-hour dietary recall interview, a 3-day food diary, and a food frequency questionnaire. Because of the well-known difficulties of assessing nutritional intake, it is preferable to use multiple measurement methods (Block, 1982).

The 24-hour dietary recall interview was conducted using standardized techniques and food models. Nutrition assessors were trained using Nutrition Coordinating Center procedures (Dennis, Ernest, Hjortland, Tillotson, & Granibsch, 1980) plus modifications to improve accuracy of children's reports (Frank, Berenson, Schilling, & Moore, 1977). Results were coded and analyzed for 27 nutrients at the Nutrition Coordinating Center at the University of Minnesota (Dennis et al., 1980). For this analysis, the percentage of calories from total fat (24-hour total fat), total caloric intake (24-hour Kcals), and milligrams of sodium (24-hour sodium) were used. Test–retest reliability, in the present study, with 30 adults and children interviewed the same day by different nutrition assessors yielded a 91% agreement on the description of 438 food items. Dietary intake values for all groups of subjects fell within normal ranges.

Each participant kept a 3-day food diary for 1 weekend day and 2 weekdays prior to each assessment. The food diaries were reviewed for completeness by nutrition assessors and then assigned a Food Record Rating of average fat and cholesterol intake (3-day fat score) using the scoring system developed for the Multiple Risk Factor Intervention Trial (Remmell, Gorder, Hall, & Tillotson, 1980). The average American diet would receive a score above 20. The range of 10–14 represents some fat modifications. A score of 4–9 indicates Phase 1-2 of the American Heart Association Diet and a score less than 3 represents Phase 3. Average milliequivalents of sodium per day were also calculated from the 3-day food diary (3-day sodium) (Jacobson, Liebman, & Moyer, 1983; Pennington & Church, 1980). Reliability of scoring was .91 for fat and .89 for salt scores (n = 20 adults and children) in the present study. Scores below 100 represented achievement of the 3-gram sodium goal for the project.

A 50-item food frequency questionnaire developed for the Special Project in Nutrition (SPIN) at the Gladstone Foundation in San Francisco was shortened to 36 items and modified to be culturally sensitive to our particular population. This questionnaire focused on sodium- and fat-containing foods. A ratio of the frequency of consumption of the 9 low sodium and/or fat foods to the 27 high sodium and/or fat foods (Food Frequency Score) was determined for *each* individual.

Assessment of Physical Activity

The measure used in the current study to assess physical activity is the 7-day Physical Activity Recall (PAR), which has been well described (Blair, 1984; Sallis et al., 1985). It is an interviewer-administered 1-week recall, with modifications to allow separate scoring of work and leisure activity. Interviewers accounted for only the portion of the day in which subjects engaged in moderate, hard, and very hard intensity activities. Same-day reliability using different assessors was 0.78 ($n = 43$) in the present study. For the purposes of this analysis we used the overall summary score, kilocalories per kilogram of body weight per day (KKD). The procedure has been validated in adults (Taylor et al., 1984) and in children (Wallace, McKenzie, & Nader, 1985).

Assessment of Physiological Indicators

Blood Pressure. The mean of three consecutive BP readings taken after a 5-minute rest period was used for this analysis. The measurement and staff certification procedures developed in the Hypertension Detection and Follow-Up Program (Curb, Labarthe, Cooper, Cutter, & Hawkins, 1983) were used for adults. For children, the cuff selection and fourth phase determination procedures suggested by Berenson (1980) and H. S. Kahn (personal communication, 1983) were utilized. In order to reduce observer bias, random-zero sphygmomanometers (DeGaudemaris, Folsom, Prineas, & Luepker, 1985) were used for all readings. Fourth-phase BP, recorded at the point at which the Korotkoff sounds became muffled, was used as the diastolic BP for children, while fifth phase was used as the diastolic BP for adults. Same-day reliability across different assessors for first-phase blood pressure was 0.87 for adults ($n = 53$) and children ($n = 47$). For fifth phase, BP in adults reliability was 0.79 ($n = 53$) and for children reliability for fourth-phase blood pressure was 0.57 ($n = 47$). All measurements were taken between the hours of 7:00 and 9:30 a.m. in the fasting state.

Body Mass Index. Weight was measured without shoes or heavy objects in pockets. Height was obtained using a secured height anthropometer. The Quetelet index (kg/m^2) was used as a measure of body mass index.

Assessment of Cognitive Change

Knowledge. An adult and a child scale were developed to measure knowledge of health behaviors related to cardiovascular diseases. The scales assess knowledge of dietary sodium, dietary fat, and exercise among both adults and children. These scales focus on "behavioral capability" rather than the link between behavior and disease. It is believed that the type of information measured in these scales is more closely related to behavior changes sought in contemporary CVD prevention trials (cf. Parcel & Baranowski, 1981). The psychometric characteristics of the scales have been reported previously (Vega et al., 1987), and they have been shown to have adequate reliability.

Self-Efficacy. Self-efficacy was measured by having subjects rate the confidence in their ability to change specific dietary and exercise behaviors. There were four questions on reducing fat intake (e.g., confidence that they can "use unsaturated vegetable oil instead of lard or shortening in cooking") and two questions concerning confidence in ability to reduce salt intake (e.g., confidence that they can "reduce salt you add both in cooking and at the table by half or more"). Two questions on exercise (e.g., confidence that they can do vigorous activity such as jogging, running, and swimming laps for 20 minutes three or more times a week) have been shown to predict actual exercise changes (Sallis et al., 1986). For the purposes of the present study, we have analyzed subjects' total confidence scores.

Analysis

SPSS-X programs were used for all analyses. One-year change scores were computed for each variable by subtracting baseline from 1-year values. Change scores were correlated between each of six family pairs: spouses, fathers and younger children, fathers and older children, mothers and younger children, mothers and older children, and siblings. Younger children were fifth- or sixth-grade subjects whereas older children were older siblings who participated in the intervention. All families had at least one fifth- or sixth-grade child. No children younger than the fifth- or sixth-grade cohort were measured.

To assess the impact of random associations, mothers, fathers, and children were randomly assigned to different families. The correlational analyses were then repeated on the randomly assigned pairs.

RESULTS

Descriptive statistics for each of the measures are presented in Table I. As can be seen, there were moderate changes in the expected direction in dietary behaviors and blood pressure but not in exercise. In general, mothers made the largest and most consistent changes across measures.

Aggregation of Behavioral Indicators

Dietary Behaviors. All family pairs except fathers and older children were significantly correlated on change in fat consumed as measured by the 3-day diet record (see Table II). In contrast, only sibling pairs were significantly correlated for change in milligrams of fat consumed as measured by the 24-hour diet recall. For salt/sodium intake, when the 3-day salt score was examined, spouses, siblings, and mother–older child pair correlations were all significant. Dietary sodium changes as assessed by the 24-hour recall were significantly but negatively correlated for father–younger child pairs only. Changes in the food frequency index were not significantly related for any family dyad.

Physical Activity. All pairs except young children and their parents were significantly correlated on change in physical activity as measured by the physical activity recall. Siblings and spouses showed the strongest concordance in KKD change.

Physiologic Indicators. Siblings' blood pressure changes were significantly correlated for both systolic and diastolic blood pressures. Spouses' changes in diastolic blood pressures were correlated but not their change in systolic blood pressure. Fathers' and their younger children's changes in body mass index were significantly negatively correlated. No other family pair's changes in body mass index were significantly related.

Cognitive Variables. The correlations between the knowledge gain of family pairs was significant for spouse and sibling pairs. No significant relationships were found between parents and children. Changes in self-efficacy were nonsignificantly correlated for all pairs except the mother–younger child pair.

Aggregation Within Randomly Constituted "Families"

Comparisons of randomly paired nonrelated "family" dyads are presented in Table III. Only one of the targeted behavior change correlations

Table I. Means (and Standard Deviations), for All Measures by Family Status for Families Who Participated in a Family Health Promotion Intervention

	Father (n = 52)		Mother (n = 98)		Younger child (n = 100)		Older child (n = 54)	
	Baseline	1 year	Baseline	1 year	Baseline	1 year	Baseline	1 year
Age (years)	37.9 (6.9)		35.4 (6.0)		11.6 (0.9)		12.5 (2.2)	
3-day fat score[a]	27.8 (10.2)	21.5 (6.7)	20.3 (8.1)	16.4 (6.6)	22.1 (6.5)	19.3 (7.4)	23.7 (8.3)	19.6 (7.9)
24-hour total fat[b]	0.40 (0.09)	0.38 (0.09)	0.40 (0.10)	0.35 (0.10)	0.37 (0.07)	0.36 (0.08)	0.35 (0.08)	0.36 (0.08)
3-day sodium (mg)	115.2 (42.5)	103.3 (47.3)	98.6 (43.4)	71.7 (34.7)	107.0 (46.1)	91.8 (38.8)	113.2 (43.6)	87.7 (34.7)
24-hour sodium (mg)	3,378 (1,813)	3,458 (2,078)	2,597 (1,319)	2,259 (1,444)	2,918 (1,262)	3,036 (1,843)	2,678 (1,070)	2,746 (1,460)
Food frequency[c]	0.39 (0.28)	0.60 (0.30)	0.44 (0.31)	0.73 (0.56)	0.42 (0.30)	0.51 (0.37)	0.44 (0.34)	0.62 (0.45)
Exercise kilocalories per kilogram per day	39.8 (8.9)	36.2 (2.7)	36.8 (3.4)	35.5 (5.2)	38.5 (4.1)	35.1 (4.8)	37.9 (4.2)	35.2 (3.2)
Systolic BP	120.5 (13.6)	114.6 (14.5)	111.1 (12.2)	108.3 (12.0)	101.3 (9.0)	100.9 (9.2)	99.3 (10.8)	100.7 (11.0)
Diastolic BP	78.7 (11.4)	75.6 (11.4)	72.0 (9.7)	71.5 (10.0)	68.0 (8.7)	64.4 (14.0)	64.8 (10.8)	55.3 (26.9)
Body mass index (kg/m^2)	26.6 (4.8)	26.5 (5.1)	26.5 (7.1)	26.6 (6.1)	19.1 (3.7)	20.0 (4.2)	19.3 (4.2)	20.1 (4.1)
Knowledge	9.8 (3.7)	12.0 (3.5)	9.6 (4.4)	11.8 (3.4)	3.9 (1.9)	5.9 (2.2)	3.9 (2.3)	5.5 (2.3)
Self-efficacy	33.4 (7.2)	33.8 (7.3)	33.4 (5.6)	33.0 (7.5)	28.6 (7.5)	29.4 (8.4)	28.9 (6.1)	29.8 (8.2)

[a]See Dietary Behavior assessment for description.
[b]Percent of calories from all fats calculated from 24-hour diet recall.
[c]Ratio of low sodium, low fat food to high sodium, high fat food items endorsed.

Table II. Correlations in One-Year Changes Observed Between Family Pairs Who Had Participated in Health Behavior Change Program

Observed change	Spouses	Father-younger child	Father-older child	Mother-younger child	Mother-older child	Siblings
Targeted behavior						
3-day fat scores	.51[b]	.20	.34	.10	.62[b]	.35[b]
3-day salt scores	.38[b]	.49[b]	.20	.44[b]	.49[b]	.46[b]
24-hour total fat	.23	−.05	.15	.18	.09	.36[a]
24-hour total sodium (mgs)	.12	−.48[b]	−.17	−.31	−.03	.11
Food frequency index	.01	.05	.04	.14	.11	.12
Kilocalories expended during exercise	.43[b]	.07	.36[a]	.11	.31[b]	.49[b]
Physiologic indicators						
Systolic BP	.09	−.06	.26	.05	.14	.36[b]
Diastolic BP	.29[a]	−.03	.12	.06	.13	.55[b]
Body mass index	−.04	−.28[a]	−.21	.05	.08	−.004
Cognitive variables						
Knowledge	.33[a]	.07	.01	.02	.01	.25[a]
Self-efficacy	−.01	−.03	−.03	.25[a]	.00	−.05

[a] $p < .05$.
[b] $p < .01$.

Table III. Correlations in One-Year Changes Between Randomly Constituted Nonrelated "Family" Pairs Who Had Participated in Health Behavior Change Program

Observed changes	Spouses	Father-younger child	Father-older child	Mother-younger child	Mother-older child	Siblings
Targeted behavior						
3-day fat scores	.12	−.20	.28	−.04	.04	−.22
3-day salt scores	.14	.10	.14	.13	.18	.05
24-hour total fat	−.01	.14	.32	.24	.06	.02
24-hour total sodium (mgs)	−.10	−.19	.00	.19	.15	−.21
Food frequency index	.14	−.32[a]	.08	.15	.02	.11
Kilocalories expended during exercise	.09	.00	.24	.16	−.15	.02
Physiologic indicators						
Systolic BP	.03	−.01	.28[a]	.03	.12	.10
Diastolic BP	−.09	.31[a]	−.19	.07	−.25	.08
Body mass index	.02	.25	.13	−.15	−.29[a]	−.17
Cognitive variables						
Knowledge	−.12	.05	.11	.00	.06	−.12
Self-efficacy	.16	.08	.10	−.07	−.05	−.08

[a] $p < .05$.

for diet and exercise was statistically significant. Three of the correlations for physiologic indicators and none of the cognitive variable correlations was statistically significant.

DISCUSSION

These data suggest that the aggregation of behavior change in families who had participated in a 1-year health promotion intervention program occurred, but the level of aggregation was moderate. We found more evidence for aggregation of change among targeted behaviors than among physiologic indicators or cognitive variables.

This pattern of aggregation would be expected because the program focused on behavior change, and physiologic change might be considered an indirect consequence of the behavioral change. The changes for cognitive variables are less clearly aggregated across family members. However, spouses and siblings did aggregate on knowledge change. Changes in siblings and spouse pairs were more likely to be significantly correlated than were parents and children across most of the measures. We also found differences in aggregation patterns as a function of dietary measure employed.

Examination of the total number of correlations that were statistically significant suggests that 21 of 66 (32%) of the correlations were nonchance. By chance, we would expect only three (5%) to be significant. In our randomly constituted "families" we found four significant correlations. These results indicate that the observed aggregation of change in families is a reliable phenomenon and cannot be explained by chance.

Of the correlations for behavior change targeted in this study 14 of 36 (39%) were significant whereas 4 of 18 (22%) of the physiologic indicators and 3 of 12 (25%) of the cognitive changes were statistically significant. It is possible that longer periods between assessments are necessary for subjects to make large enough changes to be reflected in aggregation of blood pressure and body mass index. However, the relatively weak concordance in cognitive changes cannot be explained in this manner. It is interesting that knowledge changes were significantly correlated for spouse and sibling pairs only, and in each of these cases the same form of the questionnaires was being compared. For parent–child pairs, separate adult and children forms were being compared. Thus the lack of association in knowledge for the parent–child pairs may have been due to different metrics. It is also possible that these forms ascertain somewhat different knowledge domains.

We found more evidence for concordance in change for sibling pairs (64% or 7/11 of sibling correlations were significant) and spouse pairs (45% or 5/11 of spouse correlations were significant) than in parent–child pairs

(20% or 9/44 of these correlations were significant). These findings suggest that family members are more likely to influence other family members of similar ages. Research on modeling (Rosenthal & Bandura, 1978) indicates that similar models are particularly influential, and age is a very salient variable. Although the mechanisms accounting for the robust spouse and sibling correlations are not known, the data suggest that intragenerational dynamics are more important than intergenerational dynamics within families in regards to health behavior change. This finding argues against targeting the "gatekeeper" or some other single family member, in hopes that change by this person will generalize to all other family members. These data also suggest that specific intervention strategies need to be developed to enhance intergenerational family influences.

We chose to include all of the outcome measures in these analyses, even those that did not change significantly after the intervention. The overall efficacy of the intervention program is examined elsewhere in detail (Nader et al., 1989). In general, in most age-ethnic subgroups, there were significant intervention effects in knowledge, blood pressure, and dietary salt and fat, but no differences in exercise. However, for purposes of the present study these findings are only of peripheral interest. Examination of the intervention data presented in Table I indicates substantial variability in change. Without this variability the present analysis would be pointless. For all measures, some subjects improve, some stay the same, while others get worse. The question addressed here is, are these changes similar within families?

We chose to use simple change scores in this analysis because they are readily interpreted. The problems with change scores are widely recognized in the literature. In particular, the error component of a change score is often large because it absorbs error from both the pretest and posttest. As a result, the reliability of a change score is expected to be lower than the reliability of either score on which it is based. The effect of this unreliability is to attenuate correlations among change scores, ultimately resulting in a conservative bias. In other words, the change score problem biases the analysis away from detecting significant relationships. Alternative methods, such as residualized change score analysis, resolve some of these problems but introduce other biases. Thus, we felt it was appropriate to use change scores because the well-known bias worked against our ability to detect aggregation. Given the conservative bias of the tests, we elected to use the standard .05 alpha level, despite the large number of correlations.

By using multiple dietary measures, we were able to compare the effects of assessment method utilized. The strongest concordance was found using the 3-day diet record, with weaker relationships found with the 24-hour diet recall and no relationship in change as measured by the food frequency questionnaires. These findings may be due to two factors. The first factor is reliability. The 3-day food record appears to provide a more reliable yet independent representation of an individual's diet when compared to the 24-hour diet recall. The major limitation of the 24-hour diet recall is that it supplies data for only one day, a day which may not be representative of usual food practices (Garn, Larkin, & Cole, 1978). Thus, this measure is more useful in comparing group means than for representing an individual's diet intake (Gersovitz, Madden, & Smicklas-Wright, 1978). This low reliability of 24-hour recall data is expected to suppress correlations. The second potential problem concerns the food frequency questionnaire. The data from this measure are expressed as a ratio of "healthy" to "unhealthy" foods. There was a restricted range in the change of this index that may have attenuated the correlations observed in this measure.

The present study clearly indicates that families who participate together in a health promotion program tend to make similar modifications in their health habits. These results are consistent with the Epstein et al. (1981, 1987) studies of family-based treatment for childhood obesity. The contrast between actual and randomly constituted families demonstrates that the observed level of aggregation was not due to chance. Although the intrafamily correlations are moderate in size, they provide support for the importance of family influences on health habit modification.

The findings of this study provide support for the strategy of targeting families rather than individuals in health behavior intervention programs. This intervention focused on involving all family members, increasing social support, and providing materials appropriate for each age group. The present analysis indicated that the intervention was only partially successful in stimulating intrafamily influences since stronger associations in change were seen within spouse and sibling pairs, when compared to cross-generation changes. It appears that, for fifth- and sixth-grade children, parent–child influences on changing diet and exercise behaviors are not strong, and it is important to involve both generations in health behavior change programs.

REFERENCES

Atkins, C. J., Patterson, T. L., Roppe, B. E., Kaplan, R. M., Sallis, J. F., & Nader, P. R. (1987). Recruitment issues, health habits and the decision to participate in a health promotion program. *American Journal of Preventive Medicine, 3,* 87-94.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Baranowski, T., & Nader, P. R. (1985). Family health behavior. In D. C. Turk & R. D. Kerns (Eds.), *Health, illness, and families: A life-span perspective* (pp. 51-80). New York: Wiley.

Berenson, G. S. (1980). *Cardiovascular risk factors in children: The Bogalusa Heart Study.* New York: Oxford.

Birch, L. L., & Marlin, D. W. (1982). I don't like it, I never tried it: Effects of exposure on two year old children's food preferences. *Appetite: Journal for Intake Research, 3,* 353-360.

Blair, S. N. (1984). How to assess exercise habits and physical fitness. In J. D. Matarazzo, S. M. Weiss, J. A., Herd, N. Miller, & S. M. Weiss (Eds.), *Behavioral health* (pp. 424-447). New York: Wiley.

Block, G. (1982). A review of validations of dietary assessment methods. *American Journal of Epidemiology, 115,* 492-505.

Brownell, K. D., Kelman, J. H., & Stunkard, A. J. (1983). Treatment of obese children with and without their mothers: Changes in weight and blood pressure. *Pediatrics, 71,* 515-523.

Charney, E., Goodman, H. C., McBride, M., Lyon, B., & Pratt, R. (1976). Childhood antecedents of adult obesity. *New England Journal of Medicine, 259,* 6-9.

Curb, J. D., Labarthe, D. R., Cooper, S. P., Cutter, G. R., & Hawkins, C. M. (1983). Training and certification of blood pressure observers. *Hypertension, 5,* 610-614.

Degaudemaris, R. D., Folsom, A. R., Prineas, R. J., & Luepker, R. V. (1985). The random-zero versus the standard mercury sphygmomanometer. A systematic blood pressure difference. *American Journal of Epidemilogy, 121,* 282-290.

Dennis, B., Ernest, N., Hjortland, M., Tillotson, J. L., & Granibsch, V. (1980). NHLBI nutrition data system. *Journal of the American Dietetic Association, 77,* 641-647.

Eastwood, M. A., Brydon, W. G., Smith, D. M., & Smith, J. H. (1982). A study of diet, serum lipids, and fecal constituents in spouses. *American Journal of Clinical Nutrition, 36,* 290-293.

Epstein, L. H., Koeske, R., Wing, R. R., & Valoski, A. (1985). The effect of family variables on child weight change. *Health Psychology, 5,* 1-12.

Epstein, L. H., Nudelman, S., & Wing, R. R. (1987). Long-term effects of family-based treatment for obesity on nontreated family members. *Behavior Therapy, 2,* 147-152.

Epstein, L. H., Wing, R. R., Koeske, R., Andrasik, F., & Ossip, D. (1981). Child and parent weight loss in family-based behavior modification programs. *Journal of Consulting and Clinical Psychology, 49,* 674-685.

Farris, R. P., Frank, G. C., Webber, L. S., & Berenson, G. S. (1985). A nutrition curriculum for families with high blood pressure. *Journal of School Health, 55,* 110-112.

Feinleib, M. Garrison, R. J., & Havlik, R. J. (1980). Environmental and genetic factors affecting the distribution of blood pressure in children. In R. M. Lauer & R. B. Shekelle (Eds.), *Childhood prevention of atherosclerosis and hypertension* (pp. 271-279). New York: Raven.

Frank, G. C., Berenson, G. S., Schilling, P. E., & Moore, M. C. (1977). Adapting the 24-hour recall for epidemiologic studies of school children. *Journal of the American Dietetic Association, 71,* 26-31.

Garn, S. M., & Clark, D. C. (1976). Trends in fatness and the origins of obesity. *Pediatrics, 57,* 443-456.

Garn, S. M., Larkin, F. A., & Cole, P. E. (1978). The real problem with 1-day diet records. *American Journal of Clinical Nutrition, 31,* 1114.

Gersovitz, M., Madden, J. P., & Smicklas-Wright, H. (1978). Validity of the 24-hour dietary recall and 7-day record for group comparison. *Journal of the American Dietetic Association, 73,* 48-55.

Gottlieb, N. H., & Chen, M. S. (1985). Sociocultural correlates of childhood sporting activities: Their implications for heart health. *Social Sciences and Medicine, 5,* 533-539.

Harper, L. V., & Sanders, K. M. (1975). The effects of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology, 20,* 206-214.

Hollingshead, A. B. (1965). *Two-factor index of social position.* New Haven, CT: Yale University Press.

Israel, A. C., & Saccone, A. J. (1979). Follow-up of effects of choice of mediator and target of reinforcement on weight loss. *Behavior Therapy, 10,* 260-265.

Israel, A. C., Stolmaker, L., Sharp, J. P., Silverman, W. K., & Simon, L. G. (1984). An evaluation of two methods of parental involvement in treating obese children. *Behavior Therapy, 15,* 266-272.

Jacobson, M., Liebman, B. F., & Moyer, G. (1983). *Salt. The brand name guide to sodium content.* New York: Workman.

Karlin, S., Williams, P. T., Farquhar, J. W., Barrett-Connor, E., Hoover, I., Wall, P. W., Haskell, W. L., Bergelin, R. O., & Suarez, L. (1982). Association arrays for the study of familial height, weight, lipid, and lipoprotein similarity in three west coast populations. *American Journal of Epidemiology, 116,* 1001-1021.

Kirks, B. A., & Hughes, C. (1986). Long-term behavioral effects of parent involvement in nutrition education. *Journal of Nutrition Education, 18,* 203-206.

Klesges, R. C., Malott, J. M., Boschee, P. F., & Weber, J. M. (1986). The effects of parental influences on children's food intake, physical activity, and relative weight. *International Journal of Obesity, 5,* 335-346.

Morrison, J. A., Namboodiri, K., Green, P., Martin, J., & Glueck, C. J. (1983). Familial aggregation of lipids and lipoproteins and early identification of dyslipoproteinemia. *Journal of the American Medical Association, 250,* 1860-1868.

Nader, P. R., Baranowski, T., Vanderpool, N., Dworkin, R. J., & Dunn, K. (1983). The Family Health Project: Cardiovascular risk reduction education for children and parents. *Journal of Developmental and Behavioral Pediatrics, 4,* 3-10.

Nader, P. R., Sallis, J. F., Patterson, T. L., Abramson, I., Rupp, J. W., Senn, K. L., Atkins, C. J., Roppé, B. E., Morris, J. A., Wallace, J. P., & Vega, W. A. (1989). A family approach to cardiovascular risk reduction: Results from the Family Health Project. *Health Education Quarterly, 16,* 225-240.

Nader, P. R., Sallis, J. F., Rupp, J., Atkins, C., Patterson, T. L., & Abramson, I. (1986). The San Diego Family Health Project: Reaching families through the schools. *Journal of School Health, 56,* 227-231.

Parcel, G., & Baranowski, T. (1981). Social learning theory and health education. *Health Education, 12,* 14-18.

Patterson, T. L., Kaplan, R. M., Sallis, J. F., & Nader, P. R. (1987). Aggregation of blood pressure in Anglo American and Mexican-American Families. *Preventive Medicine, 16,* 616-625.

Patterson, T. L., Rupp, J. W., Sallis, J. F., Atkins, C. J., & Nader, P. R. (1988). Aggregation of dietary calories, fats, and sodium in Mexican-American and Anglo families. *American Journal of Preventive Medicine, 4,* 75-92.

Patterson, T. L., Sallis, J. F., Kaplan, R. M., & Nader, P. R. (in press). Influence of physical activity and diet on aggregation of body mass index in Mexican-American and Anglo families. *Journal of Obesity and Weight Regulation.*

Pennington, J. A. T., & Church, H. N. (1980). *Food values of portions commonly used* (13th ed.). Philadelphia: Lippincott.

Remmell, P. S., Gorder, D. D., Hall, Y., & Tillotson, J. L. (1980). Assessing dietary adherence in the Multiple Risk Factor Intervention Trial. *Journal of the American Dietetic Association, 76,* 357-360.

Rosenthal, T., & Bandura, A. (1978). Psychological Modeling: Theory and Practice. In S. L. Garfield & A. E. Bergin (Eds.) *Handbook of psychotherapy and behavior change* (2nd ed., pp. 621-658). New York: Wiley.

Sallis, J. F., Haskell, W. L., Wood, P. D., Fortmann, S. P., Rogers, T., Blair, S. N., & Paffenbarger, R. S. (1985). Physical activity assessment methodology in the Five-City Project. *American Journal of Epidemiology, 121,* 91-106.

Sallis, J. F., Haskell, W. L., Fortmann, S. P., Vranizan, K. M., Taylor, C. B., & Solomon, D. S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. *Preventive Medicine, 15,* 331-341.

Sallis, J. F., & Nader, P. R. (1988). Family determinants of health behaviors. In D. S. Gochman (Ed.), *Health behavior: Emerging research perspectives* (pp. 107-124). New York: Plenum Press.

Sallis, J. F., Patterson, T. L., Buono, M. J., Atkins, C. J., & Nader, P. R. (1988). Aggregation of physical activity habits in Mexican-American and Anglo families. *Journal of Behavioral Medicine, 11,* 31-41.

Taylor, C. B., Coffey, T., & Berra, K., Iaffaldano, R., Casey, K., & Haskell, W. L. (1984). Seven-day activity and self-report compared to a direct measure of physical activity. *American Journal of Epidemilogy, 120,* 818-824.

Vega, W. A., Sallis, J. F., Patterson, T. L., Rupp, J., Atkins, C., & Nader, P. R. (1987). Assessing knowledge of cardiovascular health related diet and exercise behaviors in Anglos and Mexican-Americans. *Preventive Medicine, 16,* 696-709.

Wallace, J., McKenzie, T., & Nader, P. R. (1985). Observed vs. recalled exercise behavior: A validation of the Blair seven day exercise recall for boys 11 to 13 years old. *Research Quarterly for Exercise and Sport, 56,* 161-165.

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Family Context in Pediatric Psychology: A Transactional Perspective

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The degree to which the family is seen as a significant contributor to child health conditions impacts directly on the successful functioning of the pediatric psychologist. A transactional model of family functioning is proposed for pediatric psychology. Development is considered to be the result of a three-part process that starts with child behavior that triggers family interpretation that produces a parental response. Family interpretation is presented as part of a regulatory system that includes family paradigms, family stories, and family rituals. Corresponding to the proposed three-part regulation model, three forms of intervention are discussed: remediation, redefinition, and reeducation. Clinical decision making based on this model is outlined with examples given from different treatment approaches. Implications for the treatment of families in pediatric psychology are discussed.

KEY WORDS: family context; transactional model; clinical decision making.

Pediatric psychologists' treatment of children is often the treatment of families as well. Whether providing consultation to families under the stress of parenting a child with a chronic condition or providing direct services to children with psychosomatic complaints the family is often the most immediate

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