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Complete List of Authors:	Berg, Cynthia; University of Utah, Psychology Butler, Jorie; University of Utah, Psychology Osborn, Peter; University of Utah, Psychology King, Gary; University of Utah, Psychology Palmer, Debra; University of Wisconsin-Stevens Point, Psychology Butner, Jonathan; University of Utah, Psychology Murray, Mary; University of Utah, Pediatrics, School of Medicine Lindsay, Rob; University of Utah, Pediatrics, School of Medicine Donaldson, David; University of Utah, Pediatrics, School of Medicine Foster, Carol; University of Utah, Pediatrics, School of Medicine Swinyard, Michael; Mike T. Swinward, MD, PC, Utah Wiebe, Deborah; University of Texas Southwestern Medical Center, Psychology and Psychiatry
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The Role of Parental Monitoring in Understanding the Benefits of Parental Acceptance on Adolescent Adherence and Metabolic Control of Type 1 Diabetes

Cynthia A. Berg[1], Ph.D. Jorie M. Butler[1], Ph.D., Peter Osborn[1], M.A.,

Gary King[1],

Debra L. Palmer[2], Ph.D.

Jonathan Butner[1], Ph.D.

M. Murray[3], M.D., R. Lindsay[3], M.D., D. Donaldson[3], M.D., C. Foster[3], M.D.,

M. Swinyard[4], M.D.,

& Deborah J. Wiebe[5], Ph.D.

[1]Department of Psychology, University of Utah
[2]Department of Psychology, University of Wisconsin-Stevens Point
[3]Department of Pediatrics University of Utah School of Medicine
[4]Mike T. Swinyard, MD, PC, Utah
[5]University of Texas Southwestern Medical Center

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Corresponding Author
Cynthia A. Berg
380 S. 1530 E., Department of Psychology
University of Utah
Salt Lake City, UT 84112
Tel: (801) 581-8239
FAX: (801) 581-5841
Email: Cynthia.berg@psych.utah.edu

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Abstract

Objective: The study examined 1) whether the benefits of mothers' and fathers' accepting relationships with their adolescents on diabetic control were due to parental monitoring and 2) how parents together may provide sufficient acceptance and monitoring for diabetes management. **Research Design and Methods:** Adolescents aged 10-14 with type 1 diabetes (n = 185) and their mothers (n=185) and fathers (n =145) completed assessments of parental acceptance and monitoring of diabetes tasks. Adolescents completed a modified version of the Self-Care Inventory (1) to measure adherence. Glycosolated hemoglobin (HbA_{1c}) scores were used as a marker of glycemic control. **Results:** Mediational analyses revealed that the benefits of adolescents' reports of fathers' acceptance on HbA_{1c} and mothers' and fathers' acceptance on better adherence were partially mediated by monitoring. Both mothers' and fathers' monitoring and fathers' acceptance had independent effects in predicting adherence. However, only fathers' monitoring had an independent effect on HbA_{1c} . The effect of fathers' monitoring on HbA_{1c} occurred as fathers were monitoring at a lower level than mothers. Mothers' and fathers' reports of their own acceptance and monitoring were not associated with HbA_{1c} or adherence. **Conclusions:** Results reveal the importance of fathers' acceptance and monitoring in diabetes management, a role that should be encouraged, despite the little attention it has received.

Children and adolescents with type 1 diabetes benefit from supportive and accepting parent-child relationships, with acceptance associated with better treatment adherence and metabolic control (2; 3). Warm and accepting parent-child relationships may be effective for diabetes outcomes as such relationships foster effective parental monitoring (4; 5). Parental monitoring involves regular contact with adolescents regarding their daily activities, and knowledge about and supervision of those activities (6). Although the diabetes literature has examined constructs related to parental monitoring (e.g., involvement) that are associated with positive diabetes outcomes (7; 8), involvement (i.e., who is responsible for diabetes tasks) is not synonymous with monitoring (i.e., parent really knows that diabetes tasks are completed). For instance, an adolescent could manage diabetes care tasks independently (low parental involvement), while the parent monitors the success of those independent efforts (high parental monitoring). The benefits of warm and accepting relationships may be due, in part, to accepting parents being positioned to monitor their adolescent's diabetes activities (9).

The increasing independence of adolescents from their parents in carrying out diabetes tasks (8; 10) may make monitoring by both mothers and fathers especially important (11). Ellis et al. (9) found that diabetes-specific monitoring during adolescence was associated with better metabolic control via its association with better regimen adherence. Ellis et al.'s (9) study primarily included mothers (78%) and did not examine how mothers' and fathers' acceptance and monitoring together may affect diabetes management. Although research has focused primarily on the mother-child relationship, recent work suggests that support from fathers is important, despite their lower levels of involvement (12). Fathers have been characterized as involved at a fairly minimal level

in their adolescent's diabetes management (13) and their monitoring efforts are likely to be lower than that of mothers (14). The extensive and changing daily management demands of type 1 diabetes during adolescence may mean that adolescents benefit from the acceptance and monitoring of both parents. Thus, we examined the ways that mothers' and fathers' relationships with adolescents may both be important (15).

The present study had two specific aims: (1) to examine whether the benefits of an accepting mother- and father-adolescent relationship on adherence and metabolic control are due to parental monitoring and (2) to examine the combined effects of mothers' and fathers' acceptance and monitoring, especially how parents may together provide adequate levels. We hypothesized that both mothers' and fathers' acceptance and monitoring would be predictive of diabetes outcomes, with the benefits occurring largely through effective monitoring (9). We examined both adolescents' reports of mothers' and fathers' acceptance as well as the reports of mothers' and fathers' themselves.

Research Design and Methods

Participants

The study was reviewed and approved by the University of Utah IRB. Parents gave written informed consent and adolescents gave written assent. Participants included 185 adolescents (*M* age 12.52 years, *SD* = 1.53; 53% females) diagnosed with type 1 diabetes, their mothers (*M* age 39.97, *SD* = 6.32) and 145 participating fathers (*M* age 42.26, *SD* = 6.20). Participants were recruited from a university/private partnership clinic (87.6%) and a community-based private practice (12.4%). Eligibility criteria included that adolescents were between 10 and 14 years of age, had diabetes more than 1 year, lived with mother, and were able to read and write either English or Spanish. Adolescents

had diabetes for an average of 4.78 years (*SD* = 3.0), as reported in medical records. Approximately half (49.7%) were on an insulin pump, with the remainder prescribed multiple daily injections (MDI). Mothers of adolescents on MDI reported physicians recommended an average of 4.2 insulin injections (*SD* = 1.3, range: 2 – 8) and 5.0 blood glucose checks per day (*SD* = 1.4, range: 1 – 10).

Of the qualifying participants approached, 66% agreed to participate in the present study, the first wave of a 3-year longitudinal study (reasons for refusal included commute distance 23%, too busy 21%, not interested 30%, uncomfortable with being studied 16%, time commitment 6%, other illness in family 5%, and no reason 3%**)**. Comparisons of eligible adolescents who participated versus those who did not indicated participants vs. non-participants were older (12.5 versus 11.6, $t(367)=-6.2$, $p < .01$), but did not differ on gender, pump status, $HbA_{1c,}$ or time since diagnosis (*ps* > .20). Mothers and fathers were predominantly the biological parents of the adolescent (75.4%), with remaining families primarily representing one biological parent and one step-parent**.** Families were largely Caucasian (94%) and middle class with most (73%) reporting household incomes averaging $50,000 or more annually, 51% of mothers and 58% of fathers reported education levels of 2 years of college or beyond, and an average Hollingshead Index (16) of 5, indicating a medium business, minor professional, technical status.

Measures

Parental Monitoring of Management. Parents and adolescents completed a diabetes specific scale of parental monitoring developed by the authors. The measure was based on Barber's (17) work on a parental monitoring scale, which shows excellent

reliability and external validity (18), predicting an array of positive behaviors (higher academic achievement, less drug use, more self-reliance). Our diabetes-specific scale consists of 6 items where adolescents rate on a 1 (doesn't know) to 5 (knows everything) scale how much their mother and then their father really knows about 6 aspects of diabetes care presently: 1) What your blood sugar readings are? (2) What you have eaten? (3) How much exercise you get? (4) How much insulin you have given yourself, (5) When you take your insulin shots or boluses? and (6) When you test your blood sugar? Parents report how much they know about the same aspects of diabetes care. The scale showed excellent reliability for mothers (α =.86), fathers (α =.88), and adolescents' report of mothers' (α =.90) and fathers' monitoring (α =.91).

Acceptance. The 12-item acceptance subscale from the Mother-Father-Peer (MFP) scale (19) was used to assess the supportiveness of the parent-adolescent relationship (20) (i.e., the degree to which parent communicated love, acceptance, and appreciation of the adolescent) and correlates well with measures of adolescent attachment security. Adolescents reported relationship quality with mothers and fathers on a 1 (strongly disagree) to 5 (strongly agree) scale, mothers and fathers answered the same items describing the parent-adolescent relationship. Reliability in the sample was good for all reporters (mother α =.81, father α =.71, adolescent report of mother α =.72 and father α =.83).

Adherence. Participants independently completed a 16-item Self Care Inventory (1) to assess adherence to the diabetes regimen over the preceding month, which correlates well with interview measures of adherence (1). The scale was adapted to reflect current standards of diabetes care by a certified diabetes educator (e.g., calculating

insulin doses based on carbohydrate content of meals). The scale had good internal consistency (α =.85 in our sample). We analyzed adolescent reports because our previous work (7) found such reports are most meaningful as older adolescents spend increasing amounts of time away from parents.

Metabolic Control. HbA_{1c} (*M*=8.28, *SD*=1.44, range 4.9-13.9**)** and other information (e.g., illness duration) were obtained from medical records at the initial clinic recruitment. At all sites, HbA_{1c} was measured by clinic staff using the Bayer DCA2000.

Procedure

Participants were recruited from diabetes clinics and received the measures used here in a packet of questionnaires that were to be completed individually and returned at a laboratory appointment. Mothers, adolescents, and fathers were given separate packets and instructed to complete the questionnaires separately. A cover sheet reiterated the importance of completing the questionnaires separately and asked that questions be directed to the investigators rather than family members.

Statistical methods

Correlational and multiple regression statistics were used to examine associations of mothers' and fathers' acceptance and monitoring with diabetes outcomes. In all analyses illness duration was controlled, as it is typically associated with diabetes outcomes (7). Several variables were identified as having significant skew, with log transformations improving normality, but not altering the results. Thus, the results of the untransformed variables are reported. Tests of gender differences revealed no effects on diabetes outcomes; thus gender was not included. Interactions of mothers' and fathers'

acceptance/monitoring with child age were calculated, but no interactions were found when predicting either HbA_{1c} or adherence. Age effects are thus not reported further.

Results

Means and zero-order correlations among variables are displayed in Table 1. Fathers were perceived by the adolescent as displaying less acceptance (dependent $t(179) = -3.1$, $p < .01$) and less monitoring than mothers (dependent $t(178) = -13.1$, $p < .01$). Adolescents' reports of fathers' acceptance were associated with reports of his monitoring, and both acceptance and monitoring were associated with better adherence and HbA_{1c}. Adolescents' reports of mothers' acceptance were associated with reports of her monitoring, and both were associated with more adherence, but were not associated with HbA_{1c}. Adolescents' reports of mothers' and fathers' monitoring ($r=.34$, $p < .01$) and acceptance ($r=.22$, $p < .05$) were correlated positively, suggesting that when mothers were viewed as monitoring and accepting, fathers were as well.

Adolescents' Perceptions of Parental Monitoring as Mediating the Effect of Parental Acceptance on Adherence and HbA_{1c}

We conducted hierarchical regression analyses to determine whether the effects of acceptance were mediated through monitoring following the procedures outlined by Judd and Kenny (21). For analyses of fathers' acceptance predicting adherence (see Figure 1a) and HbA_{1c} (see Figure 1b), multiple regression analyses indicated that adolescents' report of fathers' acceptance and of fathers' monitoring independently predicted both outcomes, indicating full mediation did not occur. However, the Sobel test (22), which tests for a reduction in the effect of acceptance on the outcome after controlling for monitoring, indicated partial mediation for both adherence (Sobel $z = 3.27$, $p < .01$) and HbA_{1c} (Sobel

z = -.3.19, p < .01). Thus, the benefit of fathers' acceptance for both adherence and HbA_{1c} was partially due to greater monitoring among more accepting fathers.

For the analyses of mothers' acceptance predicting adherence (see Figure 1c), a multiple regression indicated that both mothers' monitoring and acceptance were independent predictors of adherence, but partial mediation did exist (Sobel z = 3.01, p < .01). Thus, the benefit of mothers' acceptance for adherence was partially due to greater monitoring among more accepting mothers.

Interface of Adolescents' Reports of Mothers' and Fathers' Monitoring and Acceptance

To examine the second aim concerning how the acceptance and monitoring of both mothers and fathers together related to diabetes management, two hierarchical regressions were calculated with adolescents' reports of mothers' and fathers' monitoring and acceptance entered simultaneously as independent variables predicting adherence and HbA_{1c} as separate dependent variables. For the analyses predicting adherence, both fathers (β = .21, p < .01) and mothers' monitoring (β = .23, p < .01), but only fathers' acceptance (β = .24, p < .01) predicted adherence. Together adolescents' reports of parental monitoring and acceptance accounted for 31% of the variance in adherence (R^2 =.31, F(4, 177) = 19.1, p < .01). For the analyses predicting HbA_{1c}, fathers' monitoring was associated with lower HbA_{1c} (β = .-.35, p < .01). Although mothers' monitoring had no zero-order association with HbA_{1c}, once fathers' monitoring and other variables were controlled, mothers' monitoring was associated with higher HbA_{1c} (β = .18, p < .05), suggestive of a suppressor effect. Together adolescents' reports of parental monitoring and acceptance accounted for 18% of the variance in HbA_{1c} (R^2 =.18, F(4, 177) = 9.4, p < .01).

We then explored whether the findings that reports of fathers' monitoring, but not mothers' monitoring were associated with HbA_{1c} could reflect that fathers had a lower level of monitoring than mothers. That is, the results could reflect detriments of very low father monitoring rather than differential benefits of comparable levels of monitoring. A multiple regression with mean duration, centered fathers' monitoring (subtracting the mean from each individual's score, (23)), and the quadratic effect of centered fathers' monitoring predicting HbA_{1c} indicated that the linear effect of fathers' monitoring was not significant ($\beta = .06$, $p = .38$), but the quadratic effect was significant ($\beta = .46$, $p < .01$). The quadratic effect indicated that the positive association of fathers' monitoring with HbA_{1c} predominantly occurred at the low end of fathers' monitoring. Once fathers' monitoring achieved the same level as mothers' mean level, the benefit to HbA_{1c} was no longer apparent. This was confirmed by conducting a multiple regression analysis with perceptions of fathers' monitoring predicting HbA_{1c}, recentering fathers' monitoring to the same mean as mother's monitoring; in this analysis, fathers' monitoring became nonsignificant. Thus, the association of fathers' monitoring with HbA_{1c} appeared due to the detriments of very low levels of fathers' monitoring.

In sum, adolescents' perceptions of parental monitoring partially mediated the beneficial association of their perceptions of mothers' and fathers' acceptance with adherence, and of fathers' acceptance with HbA_{1c}. Both fathers' and mothers' monitoring and fathers' acceptance had independent positive effects for adherence, but only fathers' monitoring was beneficial for HbA_{1c}. Follow-up analyses indicated that the low levels of monitoring among fathers were especially detrimental for HbA_{1c} .

Mothers' and Fathers' Reports of Monitoring and Acceptance

Parallel analyses were conducted to examine whether parents' own reports of acceptance and monitoring predicted adolescents' HbA_{1c} and adherence. These analyses were restricted to the 145 families with a participating father. Adolescents who had a participating father were significantly different from those who did not on several variables: HbA_{1c} (8.1 vs. 9.2, respectively, $t(183) = -4.43$, $p < .01$), adolescents' report of fathers' monitoring (4.6 vs. 4.0, $t(178) = 4.59$, $p < .01$), and adolescents' reports of fathers' acceptance (4.3 vs. 3.6, $t(178) = 4.40$, $p < .01$). No differences were found in adherence, or in adolescents' perceptions of mothers' monitoring or acceptance. No significant main effects were found for mothers' or fathers' reports of their own acceptance and monitoring on either adherence or HbA_{1c} ($p > .05$). The lack of association of parents' own reports of monitoring and acceptance with adherence or HbA_{1c} prevented mediational modeling.

Conclusions

The results reveal the importance of the parent-adolescent relationship, especially the relationship with father, for effective diabetes management. Consistent with our hypotheses, the beneficial associations of adolescents' perceptions of the acceptance of mother and father with adherence were partially mediated through their perceptions of parents' monitoring. For fathers only, the benefit of adolescents' perceptions of acceptance on HbA_{1c} was partially mediated through monitoring. Follow-up analyses revealed that the importance of adolescents' perceptions of fathers' monitoring occurred largely for low levels of fathers' monitoring. The effect of fathers' monitoring occurred because of the larger numbers of fathers monitoring at very low levels, levels that were less characteristic of mothers. The suggestion is that there may be an adequate level of

parental monitoring (in our sample characterized by mothers' level of monitoring) that is adequate for the maintenance of good metabolic control, beyond which additional monitoring may not have additional benefits (24; 25).

The findings that part of the benefit of warm and accepting parental relationships for diabetes outcomes occurs through parental monitoring are consistent with Ellis et al. (9). Ellis et al. also found that when monitoring and acceptance were both used to predict diabetes outcomes, only monitoring remained as a significant predictor. The greater effect of parental acceptance found in our study could be because our acceptance measure captured more broadly the affective quality of the parent-adolescent relationship, whereas Ellis et al. used a diabetes-specific measure of acceptance. In addition, the greater effect of monitoring in Ellis et al. may be because their measure contained an element of parental involvement (e.g., how often do you check your child's insulin vials), which has been related to adherence and metabolic control (8). Additional measurement modeling is needed to ascertain whether existing measures of parental involvement, acceptance and support, and monitoring are distinct or overlapping.

Our results indicate that it is adolescents' perceptions of acceptance and monitoring that predicts diabetes outcomes, rather than parents' perceptions, in contrast to Ellis et al, who found effects for parents' perceptions. The greater diversity in family background and in the range of diabetes control in Ellis et al's sample may have contributed to the greater effect of parents' perceptions. In our study, adolescents did not perceive the same level of monitoring as mothers and fathers perceived. Adolescents' perceptions of monitoring undoubtedly were influenced by knowledge of how much they disclose to parents, a critical component of monitoring that parents did not have access to

(26). A measurement implication is that assessment of the parent-adolescent relationship is different when captured via adolescent versus parent report.

In comparing fathers' and mothers' monitoring and acceptance on diabetes outcomes, we see that only fathers' acceptance but both fathers' and mothers' monitoring predicted adherence. Thus, the monitoring of both fathers and mothers make independent contributions in understanding adherence. Adolescent adherence appears to receive benefit from the monitoring efforts of both fathers and mothers. Future research is ongoing to uncover whether mothers' and fathers' monitoring efforts are similar or whether their independent effects derive from monitoring efforts that are different, but perhaps complementary. However, only fathers' monitoring was independently associated with $HbA_{1c.}$ There was no indication that low levels of fathers' monitoring were offset by mothers' monitoring. The positive correlations between fathers' and mothers' monitoring and acceptance indicated that in general, there was at least modest correspondence in the levels of mothers' and fathers' monitoring and acceptance.

Mothers' and fathers' acceptance and monitoring were also not moderated by age, indicating that the benefits of acceptance and monitoring exist across the pre- to mid-adolescence age range (10-14 years), a time when parents are decreasing their level of involvement in diabetes management (8; 10). The importance of fathers' acceptance and monitoring may differ when examined across a broader age range, given Wysocki and Gavin's observations regarding the increasing importance of fathers during mid to late adolescence (12).

The present study has some limitations. First, our sample consisted of educated, Caucasian, and largely two-parent families. Parental monitoring (especially from fathers)

may be even more important for diabetes outcomes in a more diverse sample (9) such as when fathers are absent from the family (27) as seen in our results which showed effects for adolescents' reports of fathers based on all fathers versus no effects when participating fathers were analyzed. Our results indicate that fathers who participate in research are more likely to be perceived by their adolescents as accepting and monitoring than fathers who do not participate. An important implication of our findings it that different families are sampled depending on whether information about the father-adolescent relationship comes from adolescents (where a broader range of fathers are sampled) versus fathers themselves. Finally, although our results suggest that monitoring may be a plausible mediator of the association of acceptance with diabetes outcomes, our cross-sectional data prevent us from making temporal distinctions between presumed cause and effect. An examination of such cause and effect relationships would require experimental or intervention type research.

Results suggest that part of the benefit of mothers' and fathers' acceptance on diabetes management occurs through parental monitoring. While both mothers' and fathers' monitoring are important for adherence, low father monitoring appears especially detrimental for glycemic control during adolescence. Attempts to include fathers by encouraging their clinic attendance, stressing their daily involvement in diabetes care tasks, and encouraging collaboration between mothers and fathers may be beneficial for adolescents' diabetes management. In addition, interventions that target fathers who monitor at low levels may be an important component to the clinical management of diabetes. Encouraging fathers to be not only supportive (12), but also to monitor their

child's diabetes may be crucial across adolescence, when difficulties in adherence, metabolic control, and emotional adjustment are apparent (28-30) .

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Table 1 Means, Standard Deviations (SD), and Correlations Among Primary Study Variables

	2	3	4	5[a]	6	7	8	9	10	11[a]	12	Mean (SD) range
1. Age	.13	-.19*	-.23**	-.29**	-.32**	-.11	.12	-.19*	.14	-.10	-.11	12.5 (1.52) 10-14
2. Illness Duration (yrs)		-.01	.03	.09	.10	.01	.04	-.08	.11	.10	.08	4.78 (3.00) 1-12
3. A report of F Monitoring			.34**	.48**	.17*	.40**	.25**	.41**	-.36**	.12	.22**	2.99 (1.09) 1-5
4. A report of M Monitoring				.22**	.28**	.15*	.34**	.37**	.04	.26**	.09	4.09 (.82) 1-5
5. F report of F Monitoring					.34**	.18*	.00	.19*	-.21*	.31**	.04	3.36 (.71) 1-4.83
6. M report of M Monitoring						.03	-.08	.13	-.13	.12	.22**	3.87 (.67) 1-5
7. A report of F Acceptance							.22*	.40**	-.28**	.32**	.22**	4.17 (.83) 1-5
8. A report of M Acceptance								.36**	-.13	.15	.11	4.33 (.66) 1-5
9. Adherence									-.20**	.18*	.09	3.94 (.59) 1.06-4.88
10. HbA_{1c}										-.11	-.05	8.28 (1.44) 4.9-13.9
11. F report of Acceptance											.09	4.59 (.47) 3-5
12. M report of Acceptance												4.69 (.48) 1-5

A=Adolescent; F=Father's; M=Mother's

[a] N=145, fathers participating, *, $p < .05$, ** $p < .01$*

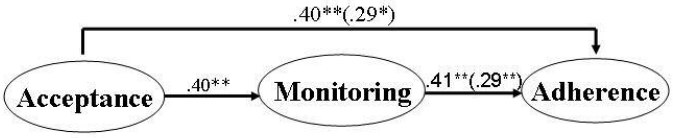

Fig 1a *Model of adolescents' perceptions of fathers' monitoring as a mediator of the effect of acceptance on adherence*

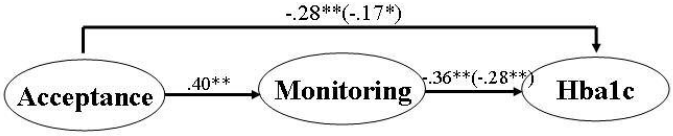

Fig 1b *Model of adolescents' perceptions of fathers' monitoring as a mediator of the effect of acceptance on Hba1c*

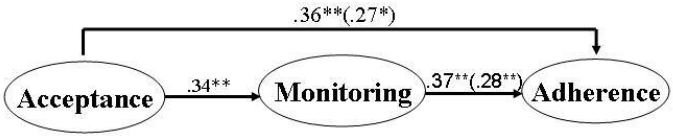

Fig 1c *Model of adolescents' perceptions of mothers' monitoring as a mediator of the effect of acceptance on adherence*

Note. Coefficients outside the parentheses are zero-order coefficients, while those inside parentheses are partial regression coefficients from equations that include the other variable in the model.

$^{**}p < .01$; $^{*}p < .05$

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