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Daily Parental Knowledge of Youth Activities Is Linked to Youth Physical Symptoms and HPA functioning

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Abstract

Considerable evidence documents linkages between parental knowledge of youth activities and youth risky behavior. We extended this research to determine whether parental knowledge was associated with youth physical health, including reports of physical symptoms (e.g., headaches, stomachaches) and a biomarker of hypothalamic pituitary adrenocortical (HPA) axis functioning (i.e., salivary cortisol levels). Participants were children of employees in the Information Technology division of a Fortune 500 company (*N* = 132, Mean Age Youth = 13.39 years, 55% female) who participated in a daily diary study. Data were collected via telephone calls on eight consecutive evenings. On four study days, cortisol samples were collected at 4 time points (waking, 30 min after waking, before dinner, bedtime). Multi-level models revealed that, at the between-person level, youth whose parents had higher average knowledge about their activities, exhibited lower bedtime cortisol levels. Furthermore, at the within-person level, on days when parents displayed more knowledge than usual (relative to their own eight-day average), youth had lower before-dinner cortisol than usual. Linkages between average parental knowledge and physical health symptoms were moderated by youth age: Younger but not older adolescents whose parents were more knowledgeable had fewer physical health symptoms, on average. A next step is to identify the processes that underlie these associations.

Keywords

parental knowledge; daily diary; physical health; HPA system; cortisol

Parental knowledge about youth experiences, activities, whereabouts, and companions, has been linked to lower levels of youth risky behaviors (Crouter & Head, 2002; Lippold, Coffman & Greenberg, 2014; Lippold, Greenberg, Graham, & Feinberg, 2014; Racz & McMahon, 2011). Parents' knowledge emerges from youth's self-disclosures to them as well

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as through parents' own efforts to solicit information or exert behavioral control (Kerr, Stattin, & Burk, 2010; Lippold, Greenberg, & Collins, 2013), with a recent study showing that knowledge was associated with positive youth outcomes regardless of how parents obtained their knowledge (Lippold et al., 2014). Importantly, the larger literature on parental knowledge documents that it is one important means through which parents influence their children's well-being: Knowledge serves as a mediator that links both parental solicitation and child disclosure to youth outcomes (Lippold et al., 2013; Vieno, Nation, Pastore, & Santaniello, 2009). In the face of its significance as a dimension of parenting, however, research on parental knowledge has focused on youth risky behavior outcomes, and we know little about whether parental knowledge has implications for other domains of youth well-being. Accordingly, this study built on prior research to test the relations between parental knowledge and youth's physical health outcomes, including youth's health symptoms and stress-related physiology. The latter was assessed by a biomarker of hypothalamic pituitary adrenocortical (HPA) axis functioning -- salivary cortisol levels. Our second goal was to test whether the links between knowledge and youth health were moderated by youth age and/or gender. These findings may illuminate possible intervention targets, such as strategies that may increase parent-child communication and knowledge, for family-based interventions aimed to promote physical health during adolescence.

A Daily Diary Approach

We used a daily diary approach to test the linkages between knowledge and youth physical symptoms and HPA functioning. Most studies of parental knowledge rely on global reports, whereby parents and/or youth rate parents' average level of knowledge, usually over the past month (Lippold et al., 2014; Racz & McMahon, 2011). Although such global reports have been linked to youth outcomes, they can be limited by response biases and memory demands. Further, both knowledge and youth health may fluctuate on a day-to-day basis (Almeida, 2005). That is, parents may be more knowledgeable and youth may experience more health symptoms on some days than on others. Diary data can be used to investigate two types of associations. Between-person associations test whether or not average levels of knowledge are linked to better youth health outcomes. Within-person associations test whether, on days parents are more knowledgeable than usual (i.e., relative to their own cross-day average), youth have more positive health outcomes than usual that same day. Such within-person analyses control for stable between-person differences, or selection effects, and thereby allow for stronger inferences about the links between knowledge and health. Thus, in this study we used multi-level modeling (MLM) to analyze links between average levels of parental knowledge (between-person associations) and youth health, as well as to assess whether day-to-day variations in parents' knowledge were linked to same day variations in youth health (within-person associations).

As noted, we assessed youth's physical health in terms of both health symptoms and HPA functioning. We used salivary cortisol as a biomarker of youth's stress-related physiology. Healthful patterns of cortisol—the hormonal byproduct of the HPA system—are marked by a diurnal rhythm wherein cortisol levels peak shortly after waking and then decline over the course of the day (McEwen, 1998). To the extent that parental knowledge is linked to better HPA functioning, the cortisol levels of youth with more knowledgeable parents should

exhibit a healthful pattern of rising sharply in the morning, and then declining across the course of the day, resulting in low levels of cortisol before dinner and at bedtime. Dysregulated HPA functioning has been linked to disrupted immune processes and an increased risk of disease (Miller, Chen, & Parker, 2011; Neeck, Federlin, Graef., Rusch Schmidt, 1990; Repetti, Robles, & Reynolds, 2011). However, the causal process that may link HPA functioning and illness and disease are not yet clear (Miller et al., 2011). Thus, we assessed both physical health symptoms and salivary cortisol in this study.

Parental Knowledge and Youth Physical Health and HPA Functioning

Our study is grounded in prior research and theory suggesting that parental knowledge may have important linkages to health behaviors and youth stress, with positive implications for their HPA functioning and fewer physical health symptoms. In this study, we assessed the direct associations between parental knowledge and indices of HPA functioning and youth physical health.

Parental knowledge may be linked to youth stress-related physiology and physical health symptoms and at both daily and average levels. If parents are knowledgeable about their youth experiences on a particular day, they may be more likely to be aware of and promote behaviors and routines that improve physical health and reduce youth stress-- such as exercising, sleeping, and eating well (Buckley & Schatzberg, 2005; Cohen, 2004; Meerlo, Koehl, van der Borght, & Turek, 2002; Pedersen & Hoffman-Goetz, 2000; Traustadóttir, Bosch, & Matt, 2005). In addition, knowledgeable parents may be more aware of their children's physical well-being and thus more likely to intervene in ways that prevent illness and promote more rapid recovery when their children do become ill. For example, parents may limit their children's exposure to friends who are ill or provide medication and arrange doctors' visits. Some of the linkages between knowledge and youth health may occur on the same day: For example, parents who know that a child is not feeling well may encourage more restful activities, resulting in fewer physical symptoms and healthier HPA functioning on that same day. Yet, some of the associations between parental knowledge and youth health may be cumulative, and it may be that average parental knowledge, rather than knowledge on particular day, is most closely linked to physical health and HPA functioning. For example, the effects of parenting practices such as enforcing curfews and bedtimes, encouraging a balanced diet, and promoting physical activity may not be immediate, but build up over time (Cohen, 2004; Umberson, Crosnoe, & Reczek, 2010; Kitzman-Ulrich et al., 2010). Therefore, average levels of knowledge may also be important for promoting healthy HPA functioning and physical health.

Furthermore, when their parents are more knowledgeable about their activities, whereabouts and companions, youth may develop a sense of safety and security, which in turn, buffers youth against the effects of stressors (Cummings & Davies, 1996). Youth with knowledgeable parents may feel more comfortable communicating with their parents and therefore may experience greater parental support and advice. Social support has been linked to improved physical health and HPA functioning among adults (Lutgendorf et al., 2005; Turner-Cobb, Sephton, Koopman, Blake-Mortimer, & Spiegel, 2000), as well as fewer physiological responses when faced with a stressor (Uchino, 2006). Similarly, because of

improved communication and problem solving support, youth with knowledgeable parents may experience fewer stressors and may appraise stressors are less threatening with weaker physiological responses to those stressors (Bai & Repetti, 2015; Power, 2004). Therefore, on a particular day, youth with parents who are knowledgeable may experience fewer physical symptoms and healthier cortisol patterns that same day. However, the effects of parental knowledge on youth health may also be cumulative. It may be that only when parents have high knowledge across many days that youth may develop a strong sense of safety and support. Thus, average levels of knowledge may also have associations with youth physical symptoms and HPA functioning.

The linkages between parental knowledge and health may also be due to child effects: Children's health may influence the level of knowledge that their parents obtain. Parental knowledge is a transactional process, with parents providing support and seeking information and youth making decisions about what information to share with parents (Racz & McMahon, 2011). Thus, youth with better health and HPA functioning may be more likely to share information with their parents, resulting in more knowledge (Stattin & Kerr, 2000). In contrast, those who experience stressors and physical symptoms may withdraw and fail to disclose information to their parents. Parents may also track the activities of their children who are ill more than children who are healthy. Perceptions also may matter: Youth with better health may perceive their parents as more engaged and helpful, leading to greater disclosure.

For these and other reasons, higher levels of both daily and average parental knowledge may be linked to fewer youth physical health symptoms such as headaches and stomachaches as well as more healthful HPA functioning. As such, an important step is to examine the links between parental knowledge and indices of youth's physical health. Establishing linkages between knowledge and youth health is an important first step that may lay the groundwork for future studies that unpack the mechanisms through which knowledge exerts its effects on youth health.

Variations in Knowledge-Health Linkages by Youth Gender and Age

The associations between parental knowledge and youth health may vary as a function of youth characteristics, in particular, gender and age. Moderation analysis may shed light on subgroups to target in family-based interventions aimed to improve child health. First, theory and research suggest that parents monitor girls more than boys and that girls disclose more information to their parents (Waizenhofer, Buchanan, & Jackson-Newsom, 2004). Further, girls tend to be more relationship-oriented than boys (Leaper, 2002), with the result that they may be more strongly affected by parental knowledge, and knowledge may be more predictive of health for girls than boys.

Parental knowledge may also have a stronger impact on the health of younger as compared to older adolescents. With age, youth spend less time with their parents and more unsupervised time with their peers, making it more difficult for parents to obtain knowledge about their activities (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), and several studies documented declines in parental knowledge across adolescence (Laird, Pettit, Bates,

& Dodge, 2003; Masche, 2010). Further, youth become more self-directed around health behaviors with age. Food choices, decisions to engage in physical activities and bedtimes are increasingly viewed by adolescents as their own, rather than their parents', jurisdiction (Smetana, 2011). Thus, as children become older, knowledgeable parents may be less likely to promote specific health behaviors due to youth's increasing autonomy (Wray-Lake, Crouter, & McHale, 2010). Further, as youth become older, they may share less information with their parents (Keijsers & Poulin, 2013). Parents may be less aware of stressors that youth experience and therefore have fewer opportunities to provide support and guidance. Further, older adolescents may be more likely to spend time with and seek support from peers rather than parents in dealing with stressors (Larson et al., 1996). As such, the relation between parental knowledge and health may be stronger for younger than older adolescents.

Current Study

In sum, we addressed two goals. First, we assessed the links between youth reports of parental knowledge and HPA functioning and physical health symptoms, testing two kinds of hypotheses: (a) At the between-person level, youth who reported lower levels of parental knowledge, on average, will also report more physical health symptoms and exhibit less healthful levels of cortisol (e.g., high levels of cortisol before dinner and at bedtime, flatter evening slopes, and blunter next-day morning rise); and (b) at the within-person level, controlling for average knowledge, on days when youth reported lower parental knowledge than usual, they also will report more physical health symptoms and exhibit less healthful cortisol patterns. Our second goal was to test whether the associations between parental knowledge and youth health were moderated by youth gender or age. We expected to find stronger associations between knowledge and youth health outcomes in girls and younger adolescents.

Method

Participants and Procedure

We used data from families who participated in the daily diary component of the Work, Family Health Network Study (WFHS) conducted in a U.S. Fortune 500 company (Bray et al., 2013; King et al., 2012). Employees from the information technology (IT) division were recruited to participate in a workplace interview. Of the 823 employees who completed a workplace interview, 222 (26.7%), were eligible for home interviews because they were a parent of a child aged 9-17 who lived at home for at least four days a week. Families in which both employee and child completed the home interview (n = 147) were eligible to participate in a daily diary study involving telephone calls and saliva collection. Recruitment for the daily diary occurred after the workplace interview. One hundred thirty-two families (89.8% of those eligible) participated in the daily diary study. The employee-parent signed separate consent forms for his/her own and child's participation, and youth assent for the diary was obtained during the home interview. Parents and their children provided information on their daily activities, emotions, and experiences via telephone calls on eight consecutive evenings (*Median* child interview start time = 8:01 PM, *SD* = 1.62 hrs). Of those who agreed to participate, 84% of parents and 88% of youth completed all eight days of interviews.

The current analyses included 132 youth (55% female; mean age = 13.39, *SD* = 2.40). The majority of youth were White (59%); 3% were African American, 15% were Hispanic, 11% were Indian Asian, 7% were other Asian, less than 1% were American Indian/Alaska Native or Pacific Islander; 3% chose more than one race. Most parents graduated from college (78%), were married or cohabitating with a partner (87%), and annual income averaged between $110,000 and $119,999.

On four diary study days (days 2, 3, 4, and 5), saliva samples were collected from youth at four time points: upon awakening, 30 minutes after waking, before dinner, and before going to bed. During the home interviews, saliva collection kits with instructions were distributed. Each kit contained 16 salivettes for collecting youth cortisol (4 salivettes/day X 4 days) along with a DVD that demonstrated saliva collection procedures. Youth were instructed to roll a cotton swab across their tongue for two minutes and then return the swab to the tube without touching it and were told not to eat, drink, or brush their teeth within 30 minutes pre-collection. Instructions for saliva collection and data collection sheet completion were reviewed with parents and youth during the first phone interview, and youth were reminded about the saliva collection on the evenings prior to scheduled collections. Youth recorded the time of each saliva sample and any medications they were taking on a separate data collection sheet. Participants refrigerated saliva samples after collection and, at the end of the saliva collection period, mailed the samples to the laboratory using prepaid overnight delivery. Upon receipt at the laboratory, saliva samples were weighed and frozen at −80 °C until later assay of cortisol in the Biomarker Core Laboratory at The Pennsylvania State University lab using commercially available EIA kits (Salimetrics, LLC, State College, PA). Assays were run on a rolling basis throughout the entire study period. The assay had a lower limit of sensitivity of 0.003 ug/dL, with average inter- and intra-assay covariances of less than 7% and 4%, respectively. Cortisol values below 0.003 ug/dL were designated as off-the-curve low and were set to the lowest level of sensitivity to the assay. Of the youth who participated in the diary calls, 96% (*N* = 126) also provided saliva samples.

Measures

Parental knowledge was assessed in the youth phone interviews using a four-item, 4-point (1 = *almost nothing*, 4 = *a lot*) scale (Stattin & Kerr, 2000). Youth were asked, “Since this time yesterday, how much did your parent really know about: “how you spent your free time?” “which friends you hung out with?” “where you went?” and “how well you behaved?” The average alpha across days was .86

Youth reported on their *daily physical health symptoms* during the telephone interviews using a five-item measure adapted from Larsen and Kasimatis (1991) which has been used across a variety of studies (Almeida & Davis, 2011; Charles & Almeida, 2006; Horn-Mallers, Almeida, & Neupert, 2005; Seltzer et al., 2009). For each item (e.g., headache, very tired, allergies, stomachache, other physical problems or discomforts [not diseases]) youth reported whether they had or had not experienced the symptom that day (0 = *no*; 1 = *yes*). Responses were summed.

HPA functioning was assessed using four indicators of youth salivary cortisol: level of cortisol before dinner and at bedtime, dinner to bedtime slope, and the Cortisol Awakening

Response (CAR). We focused on these end-of-day measures, reasoning that they would best reflect the effects of parental knowledge obtained during that day. Because the effects of knowledge may spill over to the next day (Flook, 2011), we also assessed the Cortisol Awakening Response on the following day. The Cortisol Awakening Response (CAR) was calculated as the difference between level of cortisol at wake and 30 minutes post-waking. Cortisol values expressed in nmol/l (ug/dL X 27.59) and were log transformed before analyses to adjust for skewness (Adam & Kumari, 2009).

Moderators were youth gender (0 = *male*, 1 = *female*) and youth age centered at the grand mean. Given their links with parental knowledge and/or youth health in prior research (Adam & Kumari, 2009; Crouter & Head, 2002), we also included additional controls for race/ethnicity (0 = *White;* 1= *Non-white*), parent education (0 = *Not a college graduate*, 1= *College graduate*) and daily stressors (measured by the Daily Inventory of Stressful Events which summed 5 items that asked if youth had experienced a particular stressor in a given day (0 = *no*; 1 = *yes*). Consistent with prior research, cortisol models included time of cortisol sample collection and whether or not the child was taking medications that might impact cortisol levels (0 = *no medication*, 1= *1 or more medications*) as covariates (Adam & Kumari, 2009).

Plan of Analysis

We used multi-level models to account for the non-independence of the data (i.e., days clustered within individuals; Raudenbush & Bryk, 2002). Two level models were estimated in SAS 9.3 using Proc Mixed, with days (level 1, within-person) clustered within individuals (level 2, between-person). At level 1, we included person-centered measures of the time varying knowledge measures. At level 2, we entered the between-person variables, which were grand mean centered, including the across time averages of daily stressors (person-mean). Models also controlled for parent education, youth age, and gender. Cortisol models also included time of sample collection, race-ethnicity, and medication use as control variables.

$$Level\quad 1{:}YouthOutcomes_{ti}=\mathrm{B}_{0i}+[\mathrm{B}_{1i}\,(Parental\quad Knowledge_{ti})]+[e_{ti}] \quad \text{(1a)}$$

$$Level\quad 2{:}\mathrm{B}_{0i}=\pi_{00}+[\pi_{01}\,(Parental\quad Knowledge)]+[u_{0i}] \quad \text{(1b)}$$

$$\mathrm{B}_{1i}=\pi_{10}+[u_{1i}] \quad \text{(1c)}$$

At Level 1 (daily level, equation 1a), youth *i*'s health outcomes on day *t* were modeled as a function of their daily intercept (B_{0i}), daily slope (B_{1i}), and residual variance ($e_{ti.}$). The daily slope reflects changes in youth outcomes on days when parents have more knowledge than usual (within-person). At Level 2 (between person-level), the level 1 intercept (equation 1b) was modeled as a function of the sample mean intercept (π_{00}), and the effect of parental knowledge averaged across the days (π_{01}), as well as random effects (u_{0i}). The level 1 slope (equation 1c) was modeled as the sample average daily within-person effect (π_{10}) and random effects (u_{1i}).[1]

Lagged models were run to test the linkages between daily knowledge and the cortisol awaking response (CAR) on the following day. Lagged models were similar to the same-day models, however, the lagged models also included parental knowledge from the prior day as a predictor of CAR. Thus, lagged models test the effects of prior-day knowledge on the CAR, while controlling for same-day knowledge. Whereas same-day models allowed us to investigate the same-day linkages between knowledge and cortisol, lagged models allowed us to investigate the linkages between knowledge and next-day morning cortisol patterns.

We estimated two models for each of the health outcome variables. First, we tested the main effects of parental knowledge on youth's physical symptoms and HPA functioning. Second, we tested whether the links between knowledge and youth health outcomes were moderated by youth gender or age at both the between and within-person levels. Follow-up tests of the simple slopes were conducted when interaction terms were significant at $p < .05$ (Aiken & West, 1991).

For significant effects, we calculated the percent change in the outcome variable as a result of a one unit increase in the predictor variable using the following equation:

$$\mathrm{B}_{\%\ \ change} = [exp\,(\mathrm{B}_{raw})] - 1.$$

Similar to calculating effect sizes, calculating the percent change enabled us to ascertain the strength of these associations with the outcome variables (see Adam, Hawkley, Kudielka & Caciaoppo, 2006).

Results

Descriptive Statistics

Average parental knowledge was high ($M = 3.35$ on a 4-point scale), suggesting that parents were generally very knowledgeable about youth activities (Table 1). The intra-class correlation (ICC) for parental knowledge was .54, suggesting that a substantial amount of variance (46%) occurred within individuals across days. ICCs for cortisol levels and physical health symptoms ranged from .07 to .34, also indicating substantial day-to-day variation. There were no significant correlations between youth gender and either knowledge or the health measures, except for the CAR, which indicated that girls had a steeper rise in cortisol in the morning hours. Age was significantly negatively correlated with knowledge and positively linked to before dinner cortisol levels and the CAR.

Parental Knowledge and Youth Health

As predicted, at the between-person level, when parents had higher average knowledge, youth reported lower bedtime cortisol levels (Table 2 and Figure 1). This coefficient, $B = -.12$, is equivalent to an 11.3% percent change: For every one unit increase in parental knowledge (e.g., a change in one point on the knowledge scale) , there is a 11.3% decrease

[1]Given the distribution of our physical symptoms variable, we also ran our physical symptoms model using a Poisson distribution in PROC GLIMMIX. We obtained the same results. For ease of interpretation, we present our original models in this paper.

in bedtime cortisol levels (Adam et al., 2006). At the within-person level, controlling for average knowledge, on days when parents were more knowledgeable than usual, youth had lower before dinner cortisol than usual, $B = -.10$. For every one unit increase in daily parental knowledge, there was a 9.5% decrease in before dinner cortisol levels. There were no other significant within-person associations.

Moderation by Youth Age and Gender

A significant parental knowledge by youth age interaction predicted physical symptoms at the between-person level. Tests of the simple slopes (+ / − 1 *SD*) confirmed that the links between average knowledge and youth physical health symptoms were significant for younger, $B = -.26$, $SE = .09$, $p < .01$ but not older adolescents, $B = -.002$, $SE = .08$, *ns* (Table 3 and Figure 2). For every one unit increase in average parental knowledge, there was a 23% decrease in physical symptoms for younger children. Contrary to our hypotheses, no other significant interactions involving youth age emerged, nor was there evidence of gender moderation (not shown).

Discussion

High parental knowledge has been linked to a lower levels of a host of youth risky behaviors, ranging from delinquency and substance use to risky sexual behavior (Racz & McMahon, 2011). We built on this literature to document that parental knowledge may also be linked to youth's physical health and HPA functioning. Youth who reported that their parents were more knowledgeable about their experiences, on average, exhibited lower (more healthful) bedtime cortisol levels, and younger adolescents reported fewer physical health symptoms. Further, on days when parents were more knowledgeable than usual, youth also had lower levels of cortisol before dinner. The results contributed to the literature that links parental knowledge to youth risky behavior (Racz & McMahon, 2011) by extending analyses to youth physical health outcomes, including physical symptoms and HPA functioning. Our findings suggests that interventions aimed to improve parental knowledge may have benefits not only for behavioral health, but for physical health as well. We found no prior studies that tested links between parental knowledge and youth physical health. As such, although the results require replication, this study breaks new ground and suggests directions for future research and application.

Although it was beyond the scope of this study to identify underlying processes, there are several reasons why parental knowledge may be linked to healthful HPA functioning and fewer physical health symptoms. Parents who know about youth activities may be more aware of whether or not youth engage in healthful behaviors such as physical activity, eating well, and getting adequate rest (Cohen, 2004). In turn, they may be more likely to promote healthful behaviors in their children, with positive implications for youth's physical health and stress-related physiology (Buckley& Schatzberg, 2005; Meerlo et al., 2002; Pederson & Hoffman-Goetz, 2000; Traustadóttir et al., 2005). Parents who are more knowledgeable also may know more about youth stresses and anxieties and thus can offer advice and support (Stattin & Kerr, 2000; Lippold et al., 2013). As such, youth with knowledgeable parents may experience fewer stressors and their reactions to stressors may be tempered, resulting in

more healthful HPA axis functioning as indexed by lower levels of salivary cortisol at the end of the day. As noted, future studies are needed to identity the processes underlying these associations, such as how parents' knowledge may be linked to orchestration of their children's healthful behaviors and routines and the role of knowledge as a protective factor in youth's stress and coping. Such studies would further illuminate targets for interventions aimed to improve youth health.

Our study also built on prior work by assessing the implications of daily knowledge for youth's *daily* health. Analyses revealed a significant link at the within-individual level: On days when parents have more knowledge than usual, youth exhibited lower than usual cortisol levels before dinner. Such within-person effects are notable given that they rule out stable third variable explanations, whether measured or not (Almeida, 2005). Perhaps the period before dinner, when parents and youth have recently returned home from work or school, is a time when youth are especially inclined to process the day's stressful experiences and look to parents for support and advice. Thus, interventions may need to focus on ways to encourage parent-youth communication at the end of the school day. Consistent with this possibility, there was more variance at the within-person level for cortisol before dinner than at bedtime, which may help to account for the pattern of findings. The lack of within-person associations with physical health, bedtime cortisol, and next day CAR was surprising, given that there were substantial day-to-day fluctuations in parental knowledge and most of the youth health measures. It may be that average levels of knowledge reflect parental practices, such as promoting positive health behaviors, whose effects accumulate over days (Cohen, 2004; Umberson et al., 2014; Kitzman-Ulrich et al., 2010). Because the effects of promoting healthful behavior, such as eating a balanced diet, adequate physical activity, regular bedtimes, and adequate sleep accumulate over time, average, rather than daily levels of knowledge may be more closely linked to health symptoms. Average knowledge may also reflect a family climate of connectedness, such that youth feel a sense of security--that their parents will be available when they need them--even if parents are less knowledgeable on a particular day.

Interestingly, although we found linkages between knowledge and evening and bedtime levels of cortisol, there were no significant linkages between knowledge and the CAR. Daily parental knowledge may have stronger effects on same-day cortisol levels because they are more proximal in time; next day effects may be too distal to detect effects given our measurement approach. Further, there is some evidence that the CAR is more endogenous and less likely to be affected by contextual factors than evening levels (Fries, Dettenborn, & Kirschbaum, 2009). Therefore, even average levels of parental knowledge may have fewer linkages to morning rise than to other indicators of HPA functioning.

As predicted, the link between knowledge and physical health symptoms was moderated by age and was significant for younger but not older adolescents. These findings may reflect increased self-direction, including around health behaviors, as youth become older and issues of bedtime, food choice, and activity involvement become part of the personal domain of decision-making (Smetana, 2011). Thus, interventions aimed to increase parental knowledge may have stronger impacts on younger adolescents' health. As noted research is needed to illuminate the processes underlying the links between parental knowledge and

youth health, including the role of youth autonomy. In contrast, age moderation was not evident for salivary cortisol outcomes, however, suggesting that parental knowledge may be linked to HPA functioning across adolescence. There also was no evidence of gender moderation in face of mixed findings of gender differences in parental knowledge and cortisol (Hankin & Abramson, 2001; Hardie, Moss, Vanyukov, Yao, & Kirillovac, 2002). This may be due to our small sample size and findings must be replicated, but they are suggestive that parental knowledge is significant for the physical health of both girls and boys.

Our findings should be interpreted in light of this study's limitations. First, our correlational design does not allow for conclusions about direction of effects: parental knowledge may promote youth health, but it also may be that youth with better health are more likely to see their parents as more knowledgeable. Experimental studies that, for example, test the effects of interventions designed to promote parental knowledge, would provide evidence of its causal role in youth health. Further, the sample included youth with generally well-educated parents who were employed in one industry; thus, the findings require replication on other groups of youth. We also did not measure potential processes underlying parental knowledge—health outcome linkages, a next important step in this line of research. Parental knowledge may reflect parents' solicitation or behavioral control or youth disclosure (Racz & McMahon, 2011) and its influence may be moderated by contextual factors such as the affective quality of the parent-child relationship, parental support of youth autonomy, or parenting style (Lippold et al, 2014), additional directions for future research. Further, traditional estimates of effect sizes do not apply to multi-level models (Holden, Kelley, & Agarwal, 2008). Our estimates of the percent change in our outcome variables associated with a one-unit increase in knowledge were modest, especially for our cortisol models (ranging from 9.5 to 11 percent). Clearly other factors not measured here also influence youth cortisol levels. Finally, we relied on youth self-reports of parental knowledge. Parental reports of knowledge might yield a different pattern of effects (Lippold et al., 2011).

In the face of its limitations, this study provided several important contributions to our understanding of the role of parental knowledge in youth health. We focused on physical health, assessing the linkages between knowledge and youth physical health symptoms and cortisol. The consistency of results across indicators of physical health and cortisol is noteworthy and suggests that, beyond its documented links with youth behavioral adjustment, parental knowledge also has implications for youth's HPA functioning and physical health symptoms. We used a daily diary approach, asking youth to report on parental knowledge and health symptoms across eight days. Such approaches minimize recall bias and allow us to understand how both average and daily knowledge may be linked to youth physical health. We also moved beyond self-reports of health by including a biomarker of HPA axis functioning. We know little about parental behaviors that are linked to children's physical health, but our findings suggest parental knowledge may be one means by which parents impact youth physical well-being. At the most general level, they imply that interventions aimed to improve parental knowledge may have positive implications for adolescent physical health.

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References

Adam E, Kumari M. Assessing salivary cortisol in large-scale, epidemiological research. Psychoneuroendocrinology. 2009; 34(10):1423–1436. doi: 10.1016/j.psyneuen.2009.06.011. [PubMed: 19647372]

Adam EK, Hawkley LC, Kudielka BM, Cacioppo JT. Day-to-day dynamics of experience–cortisol associations in a population-based sample of older adults. Proceedings of the National Academy of Sciences of the United States of America. 2006; 103(45):17058–17063. http://doi.org.libproxy.lib.unc.edu/10.1073/pnas.0605053103. [PubMed: 17075058]

Aiken, LS.; West, SG. Multiple regression: Testing and interpreting interactions. Sage; Thousand Oaks, CA: 1991.

Almeida DM. Resilience and vulnerability to daily stressors assessed via diary methods. Current Directions in Psychological Science. 2005; 14(2):64–68. doi: 10.1111/j.0963-7214.2005.00336.x.

Almeida DM, Davis KD. Workplace flexibility and daily stress processes in hotel employees and their children. The Annals of the American Academy of Political and Social Science. 2011; 638(1):123–140. doi: 10.1177/0002716211415608. [PubMed: 23833321]

Bai S, Repetti RL. Short-term resilience processes in the family. Family Relations. 2015; 64(1):108–119. doi: 10.1111/fare.12101. [PubMed: 26246651]

Bray, JW.; Kelly, EL.; Hammer, LB.; Almeida, DM.; Dearing, JW.; King, RB.; Buxton, OM. An integrative, multi-level, and transdisciplinary research approach to challenges of work, family, and health. RTI Press; Research Triangle Park, NC: 2013. RTI Press publication No. MR-0024-1303

Buckley TM, Schatzberg AF. On the interactions of the hypothalamic-pituitary-adrenal (HPA) axis and sleep: Normal HPA axis activity and circadian rhythm, exemplary sleep disorders. The Journal of Clinical Endocrinology & Metabolism. 2005; 90(5):3106–3114. http://dx.doi.org/10.1210/jc.2004-1056. [PubMed: 15728214]

Cohen S. Social relationships and health. American Psychologist. 2004; 59(8):676–684. doi: 10.1037/0003-066X.59.8.676. [PubMed: 15554821]

Charles ST, Almeida DM. The relation between health and negative affect: Not all symptoms are created equal. Psychology and Health. 2006; 21:1–17.

Crouter, A.; Head, M. Parental monitoring and knowledge of children.. In: Bornstein, M., editor. The handbook of parenting. 2nd ed.. Vol. 3. Lawrence Erblaum; Mahwah, NJ: 2002. p. 461-483.

Cummings EM, Davies P. Emotional security as a regulatory process in normal development and the development of psychopathology. Development and Psychopathology. 1996; 8(01):123–139. doi: 10.1017/S0954579400007008.

Flook L. Gender differences in adolescents' daily interpersonal events and well-being. Child Development. 2011; 82(2):454–461. doi: 10.1111/j.1467-8624.2010.01521.x. [PubMed: 21410907]

Fries E, Dettenborn L, Kirschbaum C. The cortisol awakening response (CAR): facts and future directions. International Journal of Psychophysiology. 2009; 72(1):67–73. doi: 10.1016/j.ijpsycho.2008.03.014. [PubMed: 18854200]

Hankin BL, Abramson LY. Development of gender differences in depression: An elaborated cognitive vulnerability–transactional stress theory. Psychological Bulletin. 2001; 127(6):773–796. doi: 10.1O37//O033-29O9.127.6.773. [PubMed: 11726071]

Hardie TL, Moss HB, Vanyukov MM, Yao JK, Kirillovac GP. Does adverse family environment or sex matter in the salivary cortisol responses to anticipatory stress?. Psychiatry Research. 2002; 112(2):121–131. doi: 10.1016/S0165-1781(02)00182-8. [PubMed: 12429358]

Holden JE, Kelley K, Agarwal R. Analyzing change: A primer on multilevel models with applications to nephrology. American Journal of Nephrology. 2008; 28(5):792–801. http://doi.org/10.1159/000131102. [PubMed: 18477842]

Horn-Mallers MC, Almeida DM, Neupert SD. Women's daily physical health symptoms and stressful experiences across adulthood. Psychology and Health. 2005; 20:389–403. doi: 10.1080/08870440512331317698.

Keijsers L, Poulin F. Developmental changes in parent–child communication throughout adolescence. Developmental Psychology. 2013; 49(12):1314–1327. doi: 10.1037/a0016693.

Kerr M, Stattin H, Burk WJ. A reinterpretation of parental monitoring in longitudinal perspective. Journal of Research on Adolescence. 2010; 20:39–64. doi: 10.1111/j.1532-7795.2009.00623.x.

King, RB.; Karuntzos, GT.; Casper, LM.; Moen, P.; Davis, KD.; Berkman, L.; Durham, M.; Kossek, EE. Work-family balance issues and work-leave policies.. In: Gatchel, RJ.; Schultz, IZ., editors. Handbook of occupational health and wellness. Springer; NewYork, NY: 2012. p. 323-339.

Kitzman-Ulrich H, Wilson DK, George SMS, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clinical Child and Family Psychology Review. 2010; 13(3):231–253. doi: 10.1007/s10567-010-0073-0. [PubMed: 20689989]

Laird RD, Pettit GS, Bates JE, Dodge KA. Parents' monitoring-relevant knowledge and adolescents' delinquent behavior: Evidence of correlated developmental changes and reciprocal influences. Child Development. 2003; 74(3):752–768. doi: 10.1111/1467-8624.00566. [PubMed: 12795388]

Larsen RJ, Kasimatis M. Day-to-day physical symptoms: Individual differences in the occurrence, duration, and emotional concomitants of minor daily illnesses. Journal of Personality. 1991; 59:387–423. doi: 10.1111/j.1467-6494.1991.tb00254.x. [PubMed: 1960638]

Larson RW, Richards MH, Moneta G, Holmbeck G, Duckett E. Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. Developmental Psychology. 1996; 32(4) doi:10.1037/0012-1649.32.4.744.

Leaper, C. Parenting girls and boys.. In: Bornsten, ME., editor. The handbook of parenting. Vol. 1. Lawrence Erlbaum; Mahwah, NJ: 2002. p. 189-225.

Lippold MA, Coffman DM, Greenberg MT. Investigating the potential causal relationship between parental knowledge and youth risky behavior: A propensity score analysis. Prevention Science. 2014; 15:869–878. doi: 10.1007/s11121-013-0443-1. [PubMed: 24292890]

Lippold MA, Greenberg MT, Graham JW, Feinberg ME. Unpacking the association between parental monitoring and youth risky behavior: Mediation by parental knowledge and moderation by parent-youth warmth. The Journal of Family Issues. 2014; 35:1800–1823. doi: 10.1177/0192513X13484120. [PubMed: 25382891]

Lippold MA, Greenberg MT, Collins LM. Parental knowledge and youth risky behavior: A person-oriented approach. The Journal of Youth and Adolescence. 2013; 42:1732–1744. doi: 10.1007/s10964-012-9893-1. [PubMed: 23269564]

Lippold MA, Greenberg MT, Feinberg ME. A dyadic approach to understanding the relationship of maternal knowledge of youths' activities to youths' problem behavior among rural adolescents. The Journal of Youth and Adolescence. 2011; 40:1178–1191. doi: 10.1007/s10964-010-9595-5. [PubMed: 20936499]

Lutgendorf SK, Sood AK, Anderson B, McGinn S, Maiseri H, Dao M, Lubaroff DM. Social support, psychological distress, and natural killer cell activity in ovarian cancer. Journal of Clinical Oncology. 2005; 23(28):7105–7113. doi: 10.1200/JCO.2005.10.015. [PubMed: 16192594]

Masche JG. Explanation of normative declines in parents' knowledge about their adolescent children. Journal of Adolescence. 2010; 33(2):271–284. doi: 10.1016/j.adolescence.2009.08.002. [PubMed: 19782392]

McEwen BS. Stress, adaptation, and disease: Allostasis and allostatic load. Annals of the New York Academy of Sciences. 1998; 840(1):33–44. doi:10.1111/j.1749-6632.1998.tb09546.x. [PubMed: 9629234]

Meerlo P, Koehl M, van der Borght K, Turek FW. Sleep restriction alters the hypothalamic-pituitary-adrenal response to stress. Journal of Neuroendocrinology. 2002; 14(5):397–402. doi: 10.1046/j.0007-1331.2002.00790.x. [PubMed: 12000545]

Miller GE, Chen E, Parker KJ. Psychological stress in childhood and susceptibility to the chronic diseases of aging: moving toward a model of behavioral and biological mechanisms. Psychological Bulletin. 2011; 137:959–995. doi: 10.1037/a0024768. [PubMed: 21787044]

Neeck G, Federlin K, Graef V, Rusch D, Schmidt KL. Adrenal secretion of cortisol in patients with rheumatoid arthritis. The Journal of Rheumatology. 1990; 17(1):24–29. [PubMed: 2313668]

Pedersen BK, Hoffman-Goetz L. Exercise and the immune system: Regulation, integration, and adaptation. Physiological Reviews. 2000; 80(3):1055–1081. [PubMed: 10893431]

Racz SJ, McMahon RJ. The relationship between parental knowledge and monitoring and child and adolescent conduct problems: A 10-year update. Clinical Child and Family Psychology Review. 2011; 14(4):377–398. doi: 10.1007/s10567-011-0099-y. [PubMed: 22086648]

Power TG. Stress and coping in childhood: The parents' role. Parenting: Science and Practice. 2004; 4(4):271–317. doi: 10.1207/s15327922par0404_1.

Raudenbush, S.; Bryk, A. Hierarchical linear models: Applications and data analysis methods. Sage Publications; Thousand Oaks, CA: 2002.

Repetti RL, Robles TR, Reynolds B. Allostatic processes in the family. Development and Psychopathology. 2011; 23:921–938. doi: 10.1017/S095457941100040X. [PubMed: 21756442]

Seltzer MM, Almeida DM, Greenberg J, Savla J, Stawski RS, Hong J, Taylor JL. Psychological and biological markers of daily lives of midlife parents of children with disabilities. Journal of Health and Social Behavior. 2009; 50:1–15. [PubMed: 19413131]

Smetana, JG. Adolescents' social reasoning and relationships with parents: Conflicts and coordinations within and across domains.. In: Amsel, E.; Smetana, J., editors. Adolescent vulnerabilities and opportunities: Developmental and constructivist perspectives. Cambridge University Press; New York, NY: 2011. p. 139-150.

Stattin H, Kerr M. Parental monitoring: A reinterpretation. Child Development. 2000; 71:1072–1085. doi 10.1111/1467-8624.00210. [PubMed: 11016567]

Traustadóttir T, Bosch PR, Matt KS. The HPA axis response to stress in women: Effects of aging and fitness. Psychoneuroendocrinology. 2005; 30(4):392–402. doi: 10.1016/j.psyneuen.2004.11.002. [PubMed: 15694119]

Turner-Cobb JM, Sephton SE, Koopman C, Blake-Mortimer J, Spiegel D. Social support and salivary cortisol in women with metastatic breast cancer. Psychosomatic Medicine. 2000; 62(3):337–345. [PubMed: 10845347]

Uchino BN. Social support and health: a review of physiological processes potentially underlying links to disease outcomes. Journal of Behavioral Medicine. 2006; 29(4):377–387. doi: 10.1007/s10865-006-9056-5. [PubMed: 16758315]

Umberson D, Crosnoe R, Reczek C. Social relationships and health behavior across life course. Annual Review of Sociology. 2010; 36:139–157. doi:10.1146/annurev-soc-070308-120011.

Vieno A, Nation M, Pastore M, Santaniello M. Parenting and antisocial behavior: A model of the relationship between adolescent self-disclosure, parental closeness, parental control, and adolescent antisocial behavior. Developmental Psychology. 2009; 45:1509–1519. doi:10.1037/a0016929. [PubMed: 19899910]

Waizenhofer RN, Buchanan CM, Jackson-Newsom J. Mothers' and fathers' knowledge of adolescents' daily activities: Its sources and its links with adolescent adjustment. Journal of Family Psychology. 2004; 18:348–360. doi:10.1037/0893-3200.18.2.348. [PubMed: 15222842]

Wray-Lake L, Crouter AC, McHale SM. Developmental patterns in decision-making autonomy across middle childhood and adolescence: European American parents' perspectives. Child Development. 2010; 81(2):636–651. doi: 10.1111/j.1467-8624.2009.01420.x. [PubMed: 20438465]

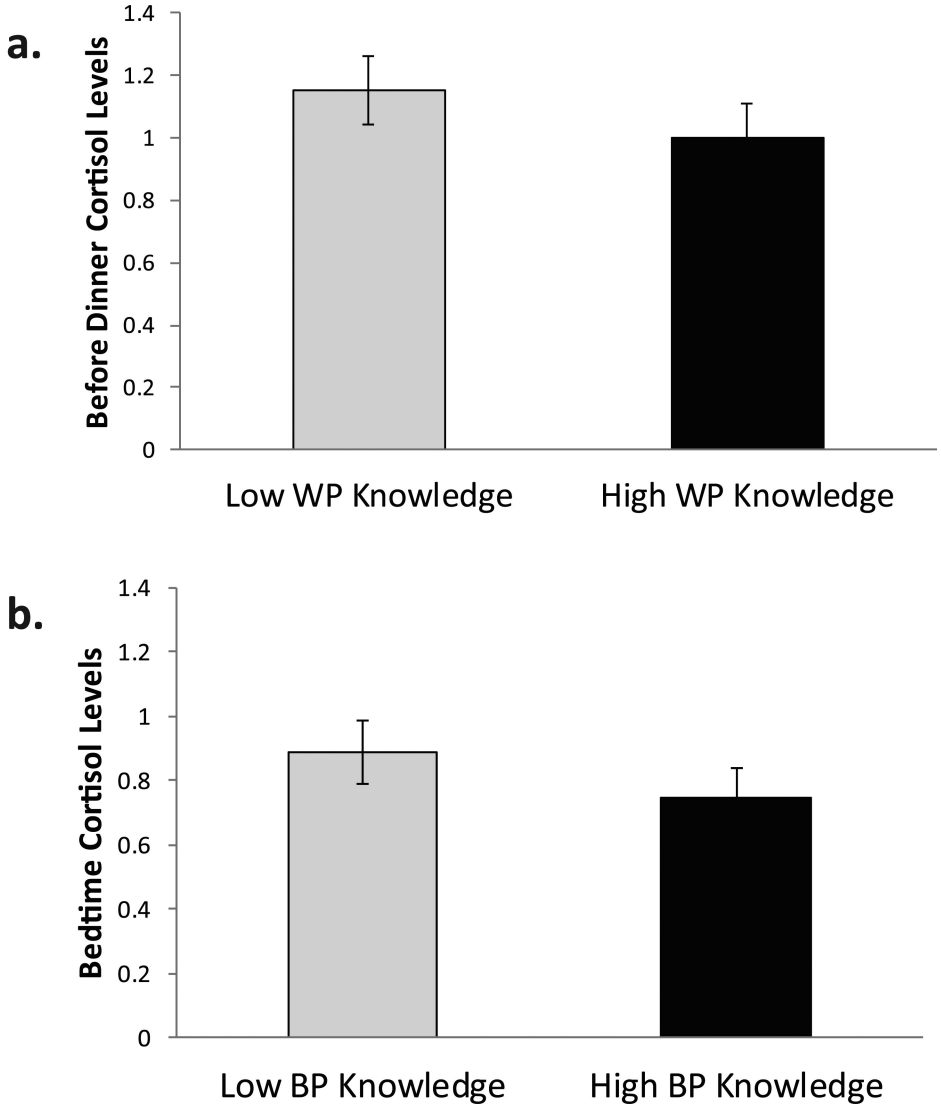

Figure 1. Main effects of parental knowledge on youth cortisol

On days youth experience higher knowledge than usual, they have lower before dinner levels of cortisol than usual (la). Youth with higher average parental knowledge have lower levels of bedtime cortisol levels (1b). WP = within-person, daily level, BP = between-person, average level. Figures are based on +/− 1 SD of knowledge. Cortisol values are presented in nmol/1.

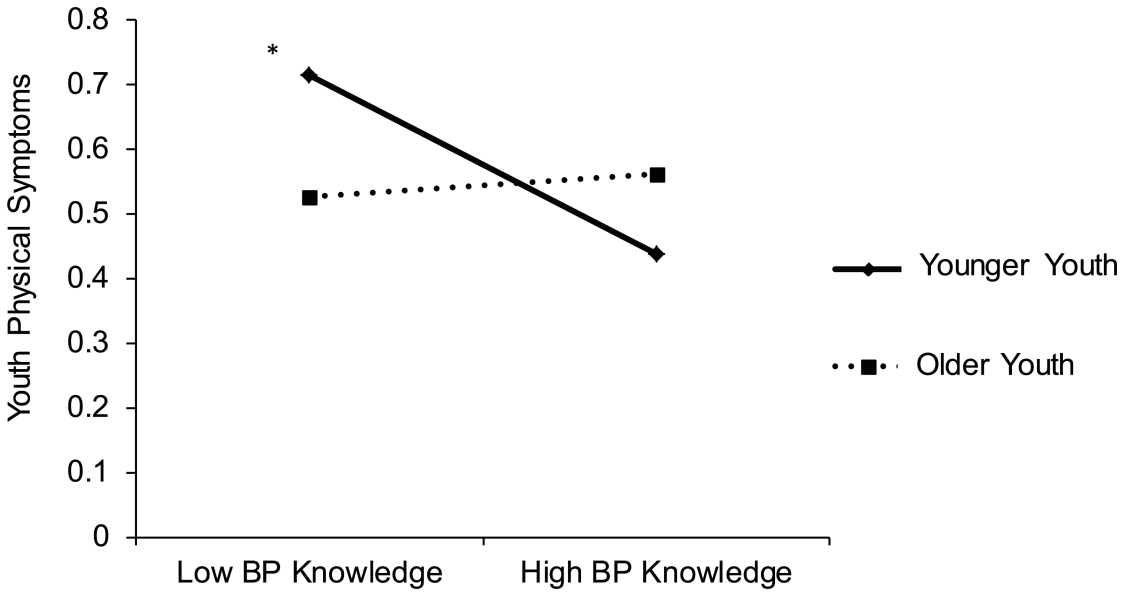

Figure 2. Youth age moderates the between-person (BP) associations of parental knowledge and youth physical health symptoms

These linkages were significant for younger (−1 SD, approximately age 11) but not older youth(+ 1 SD, age 15.8). *p < .05.

Table 1

Means, Standard Deviations, Pearson Correlations and Intra-Class Correlations of Study Variables

		BP Mean	BP SD	WP SD	1.	2.	3.	4.	5.	6.	7.	8.
1.	Parental knowledge	3.35	.62	.77								
2.	Before dinner cortisol levels	2.34	2.29	2.92	−.11							
3.	Bedtime cortisol levels	1.55	1.54	1.94	−.29**	.60***						
4.	Dinner to bedtime slope	−.39	1.80	3.06	−.04	−.23**	.31*					
5.	Cortisol awakening response	.28	.42	.65	−.14	.25*	.11	−0.08				
6.	Physical symptoms	.47	.47	.78	−.20*	.00	.01	−.02	−.07			
7.	Youth age	13.39	2.4	--	−.21*	.18*	.15	−.07	.36**	.05		
8.	Youth gender	--	--	--	.04	.06	.07	.02	.27**	.16	.16	
	ICC	--	--	--	.54	.34	.29	.07	.18	.25	-----	-----

Note. BP indicates between-person, average level. WP indicates within-person, daily level. Correlations are based on cross-day indices of daily measures. ICC indicates intra-class correlations of study variables.

* $p < .05$.

** $p < .01$.

*** $p < .001$

Table 2

Estimates (and Standard Errors) for Links between Parental Knowledge and Youth Physical Health Symptoms and HPA Functioning

	Physical Health Symptoms		Before Dinner Level of Cortisol		Bedtime Level of Cortisol		Dinner to Bedtime Slope		Cortisol Awakening Response	
	Est	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**
Fixed effects										
BP parental knowledge	−.10	(0.06)	−.02	(.06)	−.12*	(.06)	−.09	(.06)	−.05	(.06)
WP parental knowledge	−.04	(0.04)	−.10*	(.05)	.06	(.05)	.13	(.08)	−.07	(.06)
Prior-day parental knowledge	--	--	--	--	--	--	---	--	.05	(.06)
Youth age	−.01	(.02)	.03*	(.02)	.02	(.01)	−.01	(.02)	.05	(.01)
Youth gender	.14*	(.08)	.05	(.07)	.04	(.07)	.01	(.08)	.11*	(.07)
Parent education	−.09	(.08)	−.09	(.09)	−.07	(.08)	−.04	(.09)	.01	(.08)
Race	−.10	(.07)	−.02	(.08)	−.02	(.01)	.01	(.08)	.05	(.07)
Daily stressors	.51	(.11)	.16	(.10)	.11	(.10)	−.04	(.11)	.09	(.08)
BP time of sample collection	--	--	−.04	(.02)	−.03*	(.01)	−.03	(.03)	−.07*	(.03)
WP time of sample collection	--	--	−.02	(.02)	−.01	(.01)	.05	(.03)	−.13*	(.02)
Medication use	--	--	−.14	(.14)	−.09	(.10)	.16	(.12)	−.08	(.11)
Random effects										
Intercept	.20**	(.04)	.09**	(.02)	.06**	(.02)	.00	.03***	.04	(.02)
Residual	.63**	(.03)	.20**	(.02)	.19**	(.02)	.45**	.05***	.30	(.02)

$p \leq .05$

Note : BP= average, between-person effects; WP= daily, within-person effects.

** $p < .01$

*** $p < .001$

Table 3

Linkages Between Parental Knowledge and Youth Health: Moderation by Youth Age

	Physical Health Symptoms		Before Dinner Level of Cortisol		Bedtime Level of Cortisol		Dinner to Bedtime Slope		Cortisol Awakening Response	
	Est	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**	**Est**	**(*SE*)**
BP parental knowledge	−.13	(.06)	−.02	(.10)	−.09	(.06)	−.10	(.07)	−.06	(.06)
WP parental knowledge	−.04	(.05)	−.09	(.05)	.06	(.04)	−.21	(.11)	−.07	(.06)
Prior-day parental knowledge	--	--	--	--	--	--	--	--	.05	(.06)
Youth age	−.01	(.02)	.03*	(.02)	.02	(.01)	−.01	(.02)	.05*	(.02)
Youth gender	.14*	(.07)	.05	(.07)	.04	(.07)	.01	(.08)	.12	(.07)
Parent education	−.10	(.09)	−.08	(.09)	−.06	(.09)	−.04	(.09)	.00	.08
Race	−.11	(.07)	−.02	(.08)	−.01	(.01)	.01	(.08)	.05	(.07)
Daily stressors	.51	(.11)	.18	(.11)	−.01	(.07)	−.04	(.11)	.09	(.09)
BP time of sample collection	--	--	−.04	(.03)	−.02	(.01)	−.03	(.04)	−.07*	(.03)
WP time of sample collection	--	--	−.02	(.02)	.01	(.01)	.05	(.03)	−.13*	(.02)
Medication use	--	--	−.16	(.12)	−.09	(.10)	.16	(.12)	−.08	(.11)
BP knowledge × age	−.06*	(.03)	−.03	(.03)	−.04	(.02)	−.01	(.03)	--	--
WP knowledge × age	−.01	(.02)	−.01	(.02)	−.01	(.02)	.01	(.03)	--	--
Prior-day knowledge × age	--	--	--	--	--	--	--	--	−.01	(.02)

$p \leq .05$.

** $p < .01$.

*** $p < .001$

Note: BP= average, between-person effects; WP= daily, within-person effects. Models also include random effects for the intercept (not shown).