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Accuracy and Positivity in Adolescent Perceptions of Parent Behavior: Links With Adolescent Psychological Adjustment and Proinflammatory Profiles

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Abstract

Forming accurate perceptions is often linked to positive relationship and individual functioning, yet may also be detrimental in some contexts. The current study examined whether accuracy may be detrimental to individual functioning, both psychological and physiological, in an important social context: parent–adolescent relationships. Specifically, we examined whether the accuracy of adolescents' perceptions of their parent's behaviors was associated with adolescent psychological adjustment (depression and perceived stress; $N_{dyads} = 99$) and proinflammatory profiles ($N_{dyads} = 95$). Adolescents who viewed their parent's behaviors more accurately (more in line with external observers' ratings) reported worse psychological adjustment and demonstrated worse regulation of the inflammatory response. In contrast, adolescents who viewed their parent's behaviors highly normatively and positively reported better psychological adjustment. Overall, these findings suggest that adolescent accuracy regarding parent behaviors may be detrimental to adolescent psychological adjustment and inflammatory processes.

Keywords

interpersonal perception, close relationships, well-being, inflammation, adolescent

Forming accurate perceptions of others' states, traits, and behaviors is often linked to positive relationship and individual functioning (e.g., Neff & Karney, 2005; Hall, Andrzejewski, & Yopchick, 2009). Yet accurate perceptions have also been linked to negative relationship processes (e.g., Simpson, Ickes, & Blackstone, 1995; Simpson, Orina, & Ickes, 2003) and worse individual functioning, such as greater depressive symptoms (Overall & Hammond, 2012). The current study examined whether accurate perceptions are associated positively or negatively with individual functioning in an important social context: parent–adolescent relationships. Given the critical role that parent and family factors play in adolescent health and well-being (see Repetti, Taylor, & Seeman, 2002), we examined whether adolescent perceptions of their parents relate to adolescent psychological adjustment, including adolescent depression and perceived stress, and proinflammatory profiles.

In particular, we examined adolescents' perceptions of their parents on behavioral dimensions relevant to the quality of parent–adolescent interactions, such as how supportive, challenging, and attentive the parent was. To assess accuracy, we compared adolescent perceptions of their parent's behaviors after an interaction together to outside observers' ratings on the same behavioral dimensions, based on the same interaction. As such, accuracy here refers to how well adolescent perceptions map on to relatively objective ratings based upon overt behaviors exhibited within a specific interaction. Specifically, we assessed a form of tracking accuracy (Fletcher & Kerr, 2010), examining the extent to which adolescent perceptions correspond with their parent's unique behavioral profile, such as whether the parent was more supportive than challenging during the interaction. Further, we accounted for the degree to which tracking accuracy could be driven by reliance on the normative profile of behaviors (e.g., the extent to which most parents are more supportive than challenging), thereby assessing *distinctive* tracking accuracy (Biesanz, 2010; Cronbach,

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1955; Furr, 2008). Distinctive tracking accuracy therefore indicates, for example, the extent to which the adolescent and observer agree that the parent was more supportive than challenging, relative to other parents.

Of note, by assessing whether adolescents' perceptions correspond to the normative profile of parent behaviors we also obtained an indicator of the positivity of adolescents' perceptions. This is because of the normative-desirability confound (Wood & Furr, 2016), or the fact that normative profiles of personality and behaviors tend to be highly socially desirable (Borkenau & Zaltauskas, 2009; Edwards, 1957). Importantly, distinctive tracking accuracy can be independent of the positivity of perceptions, whether assessed as mean-level differences (e.g., Fletcher & Kerr, 2010; Gagne & Lydon, 2004; West & Kenny, 2011) or as agreement with the normative profile (Human & Biesanz, 2011, 2012), as examined here. For example, an adolescent may perceive that their parent is more supportive than challenging (demonstrating normative/positive perceptions), yet simultaneously agree with observers that their parent is even more supportive and less challenging than most parents (demonstrating distinctive tracking accuracy). This approach therefore enables us to disentangle accuracy from positivity in adolescent perceptions and examine how each is independently associated with adolescent functioning.

What role might the accuracy of adolescent perceptions play in adolescent psychological adjustment and inflammatory processes? On the one hand, there is evidence from the romantic relationships literature that greater accuracy is beneficial: both perceiving one's romantic partner with greater tracking accuracy (Luo & Snider, 2009; Neff & Karney, 2005) and believing one's partner views the self with greater tracking accuracy (Lackenbauer, Campbell, Rubin, Fletcher, & Troister, 2010) are linked to greater relationship satisfaction. This may be because more accurate perceptions among close others can foster communication and a shared reality, in turn promoting intimacy and closeness (e.g., Bernieri, 2001; Ickes & Simpson, 1997). There is also evidence that more accurate perceptions may promote psychological and physiological functioning. For example, those who perform better on nonverbal decoding tasks report better psychosocial functioning (e.g., Hall et al., 2009) and greater tracking accuracy regarding one's romantic partner's attitudes is associated with lower ambulatory blood pressure (Sanbonmatsu, Uchino, & Birmingham, 2011; Uchino, Sanbonmatsu, & Birmingham, 2013).

On the other hand, greater accuracy is not always associated with positive relationship processes (Haugen, Welsh, & McNulty, 2008; Sillars, Pike, Jones, & Murphy, 1984; Simpson, Orina, & Ickes, 2003). For example, in a study examining adolescent romantic couples, greater tracking accuracy regarding a partner's behaviors during an interaction was linked to both greater and lower relationship satisfaction, depending on the behavioral domain (Haugen et al., 2008). This may be because greater accuracy could expose an individual to harmful or relationship-threatening information (Ickes & Simpson, 1997; Sillars & Scott, 1983). Indeed, greater empathic accuracy for a romantic partner's more threatening, as opposed to non-threatening, thoughts and feelings is associated with declines in subjective closeness (Simpson et al., 2003).

Given that adolescent interactions, including those with parents, can involve a good deal of conflict and stress (Fuligni et al., 2009; Miller et al., 2009) and therefore, potentially include a substantial amount of negative information, it seems plausible that accuracy in this context may be more detrimental than beneficial. For example, even in generally healthy parent–adolescent relationships, parents may sometimes exhibit cold or hostile behaviors toward their child, which could in turn be quite threatening to an adolescent if accurately perceived. Indeed, negative parent behaviors are associated with worse parent-reported child health (Gottman & Katz, 1989) and greater physiological reactivity (e.g., increased blood pressure; Manczak, Mclean, McAdams, & Chen, 2015[1]). In contrast, positive parenting behaviors are associated with fewer adolescent-reported health problems (Wickrama, Lorenz, & Conger, 1997), better metabolic control over diabetes (Martin, Miller-Johnson, Kitzmann, & Emery, 1998), and less physiological reactivity (Manczak et al., 2015). What is unclear is whether adolescent perceptions of such parent behaviors play a role in the links between parent behaviors and adolescent psychological adjustment and physiological processes.

It seems plausible that adolescents' perceptions of parent behaviors may play a critical role in adolescent functioning, perhaps even more so than the objective occurrence of such behaviors. Specifically, adolescents who more accurately perceive their parents' behaviors are more likely to be exposed to threatening information than adolescents who are less accurate. In turn, accuracy could then contribute to adolescent stress and depression as well as heighten adolescent vigilance for threatening information in the future. In line with this, greater tracking accuracy regarding a romantic partner's behaviors and relationship commitment in daily life has been linked to greater depressive symptoms (Overall & Hammond, 2012). Further, this combination of greater awareness of negative parent behaviors and enhanced vigilance for future threats could contribute to the biological programming of proinflammatory tendencies, described later. Importantly, it is also possible that worse psychological adjustment could trigger greater vigilance and in turn more accurate perceptions of one's parent, in line with the literature on depressive realism (Alloy & Abramson, 1988; Lewinsohn, Mischel, Chaplin, & Barton, 1980). The current study is not able to disentangle the direction of causality but attempts to provide initial insight into whether adolescent accuracy, psychological adjustment, and proinflammatory profiles are associated.

In contrast, adolescents who do not accurately perceive their parent's behaviors may be somewhat protected from the potentially detrimental consequences of negative parent behaviors. Furthermore, adolescents who view their parent's behaviors overly positively may actually demonstrate enhanced psychological adjustment and better regulation of inflammatory processes. Indeed, holding positively biased perceptions of one's romantic partner are linked to greater relationship quality

(Murray, Holmes, & Griffin, 1996; Luo & Snider, 2009). Furthermore, overly negative perceptions of a partner's relationship commitment are associated with greater depression in romantic relationships (Overall & Hammond, 2012). Most research on positive and negative bias examines whether impressions are more or less positive relative to the target's own self-report, but similar patterns have been found when examining the normativeness of perceptions. For example, viewing a new acquaintance's personality profile as more normative is associated with greater liking over time (Human, Sandstrom, Biesanz, & Dunn, 2013) and with greater perceiver psychological adjustment (Human & Biesanz, 2011). Thus, in line with the broader argument that viewing the world in an overly positive manner can be beneficial for mental health (Taylor & Brown, 1988), it is plausible that positive adolescent perceptions of their parents could also benefit adolescents' well-being, in turn decreasing threat vigilance and proinflammatory tendencies. Further, as noted earlier with accuracy, these links are likely bidirectional, as greater psychological adjustment may also foster more positive, normative perceptions of one's parent.

In addition to examining adolescent psychological adjustment, we examined adolescent inflammatory processes because they are posited to play a critical role in linking stressful early experiences to the development of chronic diseases later in life (Miller, Chen, & Parker, 2011; Taylor, 2010). The inflammatory response, including the release of proinflammatory cytokines such as interleukin-6 (IL-6), is the body's first response to injuries and infections, assisting with the elimination of pathogens and repair of the damaged site. Inflammation is therefore critical to survival. However, exaggerated and/or prolonged inflammatory responses can become detrimental over time, potentially contributing to low-grade, unresolved systemic inflammation, which is in turn associated with the development of several chronic diseases of aging (Chung et al., 2009; Nathan & Ding, 2010). Importantly, exposure to social stress can alter the nature of this inflammatory response, both exaggerating the response and hampering its regulation. For example, stressful family environments may trigger greater vigilance for threat, both psychologically and biologically, which can in turn contribute to an exaggerated inflammatory response to pathogens (Miller et al., 2011).

Further, exposure to family stress could disrupt regulation of the inflammatory response through greater or more frequent hypothalamic–pituitary–adrenal (HPA) axis activation, enhancing cortisol output. The release of cortisol is one of the key routes through which the inflammatory response is regulated acutely; however, greater long-term exposure to cortisol can lead to resistance of immune cells to the hormone's anti-inflammatory effects (glucocorticoid resistance), via downregulation of glucocorticoid receptors (Fries, Hesse, Hellhammer, & Hellhammer, 2005; Miller et al., 2011; Miller, Chen, & Zhou, 2007). Of note, greater family conflict in daily life has been linked to dysregulated diurnal cortisol profiles in children (Slatcher & Robles, 2012), indicating that family factors may influence HPA-axis functioning. In addition, parent and family characteristics have been linked to inflammatory processes in adolescents. For example, adolescents who report greater interpersonal stress exhibit higher levels of systemic inflammation, indexed by higher levels of C-reactive protein (Fuligni et al., 2009), and a more pronounced inflammatory response to bacterial stimulation (Miller, Rohleder, & Cole, 2009). Further, adolescents who grew up in harsh family climates demonstrate a more pronounced inflammatory response to bacterial challenge and glucocorticoid resistance (Miller & Chen, 2010). Similar associations have been found in adolescents with asthma whose parents report high levels of depression and stress (Wolf, Miller, & Chen, 2008) and who perceive their parents as less supportive (Miller, Gaudin, Zysk, & Chen, 2009). Furthermore, adolescents who are perceived less accurately by their parents demonstrate greater glucocorticoid resistance (Human et al., 2014[2]), indicating that interpersonal perceptions in parent–adolescent relationships may indeed play a role in adolescent inflammatory processes.

In the current study, we examined how adolescents' perceptions of their parent relate to adolescent psychological adjustment and proinflammatory profiles. In particular, we examined two proinflammatory tendencies in adolescents: the strength of inflammatory responses to bacterial challenge and the degree of sensitivity to the anti-inflammatory signals of cortisol (glucocorticoid sensitivity).[3] We expected that more normative, positive adolescent perceptions of their parent's behavioral profile would be associated with better adolescent psychological adjustment and better regulation of inflammatory processes, whereas more accurate perceptions would be associated with greater adolescent depression and perceived stress and worse regulation of inflammatory processes.

Method

Participants

This study utilized videos of 102 parent–adolescent dyads participating in a larger study examining family life experiences and cardiovascular risk.[4] Adolescents and parents were fluent in English and in good health, defined as being free of acute infections the 2 weeks preceding the study and without a history of chronic medical or psychiatric disorders. During the visit, adolescents completed psychosocial measures, had their blood drawn to measure cytokine production, and engaged in a videotaped conversation with their parent. Psychosocial data were available for 99 parent–adolescent pairs and inflammatory data were available for 95 parent–adolescent pairs. Adolescents ranged in age from 14 to 18 years ($M_{\text{age}} = 15.87$) and lived with the participating parent. After a research assistant verbally explained the study procedures, parents provided informed consent and adolescents signed an assent form. This study was approved by the behavioral research ethics board at the University of British Columbia.[5]

Table 1. Descriptive Statistics for Parent Behaviors and Adolescent Accuracy for Each Behavior.

Parent Behavior	Adolescent Mean (*SD*)	Observer Mean (*SD*)	Adolescent–Observer Correlation	*p* Value	95% CI
Distracted	1.75 (1.33)	2.26 (1.39)	.37***	.0001	[.19, .53]
Controlling	2.38 (1.67)	2.53 (1.64)	.02	.875	[−.18, .21]
Challenging	2.35 (1.62)	2.69 (1.66)	.25*	.01	[.06, 24]
Supportive	5.63 (1.32)	4.56 (1.50)	.42**	<.0001	[.25, .57]
Agree	5.26 (1.48)	4.76 (1.38)	.32**	.001	[.13, .48]
Open	5.67 (1.31)	4.86 (1.48)	.45***	<.0001	[.28, .59]
Attentive	5.98 (1.10)	5.45 (1.37)	.26**	.009	[.07, .43]

Note. All ratings were made on a 1 (*not at all*) to 7 (*very much*) scale and averaged. Agree = agreed with adolescent; CI = confidence interval; Open = open to adolescent's point of view; *SD* = standard deviation.
*$p < .05$. **$p < .01$. ***$p < .001$.

Interaction Procedure

The parent–adolescent pair was brought into the same room and asked to have a conversation while being video recorded. Specifically, the parent and adolescent were asked to discuss three memories, involving an important challenging event that: (1) they had experienced together, (2) the adolescent experienced on his or her own, and (3) the parent had experienced during his or her own childhood that the adolescent had previously heard about. The parent and adolescent were asked to discuss each event as naturally as possible, describing what happened, how they dealt with it, and anything else important. The pair was left alone in the room during the discussion with the instructions for reference. The conversations varied in length from 5 to 30 min.

Measures

Interaction ratings. After the conversation, adolescents rated their parents on 7 behavior items on a 1 (*not at all*) to 7 (*very much*) scale (see Table 1). Each video was also coded by at least 1 of 7 trained research assistants (observers). Observers rated parent behaviors on the same set of items as adolescents to be used as the accuracy and normativeness criteria. The observers' double coded a subset of videos (29 videos; 28% of videos), and interrater reliability was fair (mean intraclass correlation = .52).

Adolescent psychological adjustment. Adolescents completed the 10-item version of the Center for Epidemiological Studies Depression Scale (Radloff, 1977) on a 0 (*rarely or none of the time*) to 3 (*most or all of the time*) scale and scores were summed ($M = 8.43$, $SD = 4.82$). Adolescents also completed the 4-item version of the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) on a 0 (*never*) to 4 (*very often*) scale and scores were summed ($M = 5.97$, $SD = 2.85$).

Adolescent inflammatory parameters. Peripheral blood was drawn from adolescents through antecubital venipuncture into Vacutainer Blood Collection Tubes (Becton-Dickinson, Oakville, Ontario, Canada) to assess inflammatory responses to bacterial stimulus and glucocorticoid sensitivity.

To examine inflammatory responses, whole blood was cultured with a bacterial stimulus, lipopolysaccharide (LPS). Although an increase in cytokine activity in response to bacterial stimulus is expected and adaptive, an exaggerated response could be problematic. Production of proinflammatory cytokines, including interleukin-1 beta (IL-1β), IL-6, interleukin-8 (IL-8), and tumor necrosis factor-alpha (TNF-α), was assessed. Whole blood was drawn into sodium-heparin Vacutainers (Becton-Dickinson, Oakville, Ontario, Canada), diluted in a 10:1 ratio with isotonic saline, and incubated with LPS (50 ng/ml; Sigma, St. Louis, MO) for 6 hr at 37°C in 5% carbon dioxide (CO_2). The supernatants were collected and frozen at −30°C until analysis. All four proteins (IL-1β, IL-6, IL-8, and TNF-α) were measured in duplicate with Meso Scale Discovery (MSD) Human ProInflammatory 7-Plex Base Kits (Rockville, MD) on an MSD SECTOR Imager 2400. These kits have a minimum detection threshold of 0.15 pg/ml, and the average variability across samples and cytokines was 6%. Previous studies comparing multiplex assays with single ELISA technology document correlation coefficients of above 0.9 (Urbanowska et al., 2006). Meso Scale Discovery platforms have greater sensitivity than multiplex technology (Chowdhury, Williams, & Johnson 2009), and MSD assays gave a broader dynamic quantitative range than Pierce Endogen multiplex assays (Pierce Biotechnology, Woburn, MA) and standard ELISA (R&D Systems, Minneapolis, MN; Toedter, Hayden, Wagner, & Brodmerkel, 2008).

Glucocorticoid sensitivity was measured by quantifying IL-1β, IL-6, IL-8, and TNF-α production in cells that had been coincubated with LPS and cortisol. The exposure to LPS should provoke an inflammatory response, but cortisol should inhibit this effect, lowering levels of proinflammatory cytokines. Lower levels of each cytokine therefore reflect higher glucocorticoid sensitivity. The same procedure for assessing responses to bacterial stimulus described above was followed, and a dose of hydrocortisone was also added to the wells (2.76×10^{-5} M). After 6 hr of incubation at 37°C in 5% CO_2, the supernatants were collected and frozen at −30°C until analysis. All four proteins (IL-1β, IL-6, IL-8, and TNF-α) were measured in duplicate with the same MSD platform as above. Due to positive skew in the distribution of the proinflammatory cytokine variables, values were log transformed prior to analyses.

Covariates. We controlled for several demographic variables, including adolescent age ($M = 15.87$, $SD = 1.17$), gender (52.53% female), ethnicity (coded as dummy variables reflecting European (48.04%) or Asian descent (30.39%), and waist circumference ($M = 76.56$, $SD = 10.24$). We present the results with covariates included to be consistent with recommended practices (O'Connor et al., 2009), but all effects reported below hold without their inclusion and these covariates did not significantly moderate any effects presented later. All effects also held controlling for parent age ($M = 46.55$) and gender (80% female), as well as parent psychosocial characteristics, including parent depression, perceived stress, and parenting style. See Supplemental Online Materials for additional analyses with all covariates.

Analytic Approach

We utilized the social accuracy modeling (SAM) procedures (Biesanz, 2010; Human & Biesanz, 2011) with *R*'s lme4 multilevel modeling package (Bates & Sarkar, 2007) to examine distinctive accuracy and positivity (for additional details and sample *R* code see Supplemental Online Materials). Briefly, we predicted adolescents' ratings of their parent on each behavior item simultaneously from (1) observer-rated parent behavior on each item after subtracting the normative mean on that item (*distinctive accuracy*) and (2) the normative mean on that item (*positivity*). Normative means were derived from the average of all observer ratings of parent behaviors. Behavior items were not reverse coded prior to analysis. Distinctive accuracy and positivity were allowed to vary randomly across parent–adolescent dyads and observers.

Although we are conceptualizing adolescent adjustment and inflammatory processes as outcomes of adolescent perceptions, to test these associations the modeling framework requires including adolescent adjustment and inflammatory measures as predictors or moderators of the accuracy and positivity slopes. For example, a positive interaction term between adolescent depression and observer ratings of parent behaviors predicting adolescent ratings indicate that observer and adolescent ratings of parent's behaviors were more closely aligned when adolescents reported greater depression.

Results

Overall, both adolescents and observers perceived parents as exhibiting more positive (e.g., supportive) than negative (e.g., challenging) behaviors, resulting in the expected highly positive normative behavioral profile (see Table 1). Further, adolescent–observer agreement was significant for each behavioral item, except "controlling" (see Table 1).

Using SAM, on average, adolescents' ratings of their parent's behaviors demonstrated significant levels of distinctive tracking accuracy, $b = .14$, $z = 2.56$, $p = .01$.[6] This indicates that adolescents' perceptions of their parents' behaviors tended to significantly correspond with their parent's unique behavioral profile, as rated by external observers. Adolescents also demonstrated significantly normative, and therefore positive, perceptions of their parents' behaviors, $b = 1.32$, $z = 20.19$, $p < .0001$.

Adolescent Psychological Adjustment

Adolescents who viewed their parent with greater distinctive tracking accuracy reported significantly greater depression and perceived stress than adolescents who viewed their parent less accurately (see Table 2). Further, adolescents who viewed their parent's behaviors more positively reported significantly lower depression and perceived stress, compared with adolescents who viewed their parent less positively.

Adolescent Inflammatory Processes

LPS-stimulated immune cell cytokine production. Adolescents who perceived their parent's behaviors more accurately produced significantly greater levels of IL-1β and marginally greater levels of IL-8 in response to LPS (see Table 2), thereby demonstrating a stronger inflammatory response to LPS stimulation. Adolescent positivity was not significantly associated with inflammatory responses to LPS stimulation.

Glucocorticoid sensitivity. Adolescents who perceived their parent's behaviors more accurately produced significantly greater levels of IL-1β, IL-6, and IL-8 when their whole blood was incubated with both LPS and cortisol, thereby demonstrating less sensitivity to the anti-inflammatory effects of cortisol (see Table 2).[7] Adolescent positivity was not significantly associated with glucocorticoid sensitivity.

Note that the pattern of results did not differ significantly as a function of whether the behavior being rated was positive or negative in nature, all *p*s > .16. Further, the primary associations between adolescent perceptions and inflammatory responses generally held when adolescent psychological adjustment was included within the models, and vice versa, all $p < .07$, demonstrating that these associations are not completely overlapping. This is in line with the generally weak correlations between adolescent psychological adjustment and inflammatory processes (see Supplemental Online Materials).

Discussion

Accurate interpersonal perceptions are often beneficial to relationships and individuals, yet there are important contexts where accuracy may be detrimental (Ickes & Simpson, 1997; Overall & Hammond, 2012; Sillars & Scott, 1983). The current study provides evidence that parent–adolescent relationships may be one context where accuracy can have negative consequences for individuals, particularly adolescents. Further, this study provides the first evidence that the negative consequences of accuracy may extend to biological processes. Specifically, adolescents who formed more accurate perceptions of their parent's behaviors during a conversation together reported greater depression and perceived stress and

Table 2. Associations Between Adolescent Accuracy and Positivity and Adolescent Functioning.

	Accuracy				Positivity			
Adolescent Functioning	*b* (*SE*)	*p* Value	*d*	95% CI	*b* (*SE*)	*p* Value	*d*	95% CI
Psychological adjustment								
Depression	.11** (.038)	.002	1.13	[.53, 3.47]	−.27** (.056)	<.0001	−1.11	[−.69, −1.81]
Perceived stress	.08* (.036)	.02	0.82	[.01, 1.43]	−.20** (.057)	.0004	−.83	[−.35, −1.39]
Inflammatory processes								
IL-1β								
LPS	.10** (.040)	.01	0.97	[.23, 1.83]	−.04 (.063)	.49	−.18	[−.67, .34]
Cortisol	.11** (.042)	.008	1.09	[.29, 1.99]	−.02 (.063)	.77	−.08	[−.60, .40]
IL-6								
LPS	.06 (.044)	.19	0.57	[−.26, 1.19]	−.02 (.066)	.72	−.10	[−.65, .41]
Cortisol	.11** (.044)	.01	1.10	[.22, 1.88]	−.06 (.067)	.39	−.24	[−.80, .29]
IL-8								
LPS	.08† (.046)	.10	0.75	[−.08, 1.46]	−.09 (.068)	.20	−.36	[−.97, .22]
Cortisol	.12** (.052)	.02	1.22	[.19, 2.08]	−.05 (.075)	.53	−.20	[−.88, .34]
TNF-α								
LPS	.03 (.044)	.51	0.29	[−.57, .82]	.02 (.064)	.70	.08	[−.47, .53]
Cortisol	.04 (.043)	.38	0.38	[−.37, 1.11]	.06 (.064)	.39	.23	[−.28, .72]

Note. CIs were estimated using 1,000 parametric resamples from the model. All analyses included the following covariates: adolescent age, gender, ethnicity, and waist circumference. A total of 99 parent–adolescent dyads were available for the psychological functioning analyses and 95 parent–adolescent dyads were available for the inflammatory processes analyses. *b* = unstandardized regression coefficients of each variable moderating accuracy and positivity slopes; CI = confidence interval; Cortisol = cytokine production after incubation with cortisol (dosage: 2.76×10^{-5} M) and LPS (dosage: 50 ng/ml); *d* = effect size estimate calculated as the change in the respective slope for a two standard deviation change in the measure of adjustment divided by the random effect standard deviation for that slope (see Gelman, 2008); GC = glucocorticoid; IL = interleukin; LPS = lipopolysaccharide; TNF = necrosis factor; *SE* = standard error.
†*p* = .10. *$p < .05$. **$p < .01$.

demonstrated worse inflammatory regulation. In contrast, adolescents who viewed their parent's behaviors highly normatively and therefore positively demonstrated better psychological adjustment, suggesting psychological benefits to positive perceptions in this context.

These findings are consistent other research indicating that accuracy can have negative consequences, perhaps by exposing an individual to threatening information (e.g., Simpson et al., 2003). For adolescents, the tendency to accurately perceive their parent's behaviors may enhance the likelihood that the adolescent is exposed to more negative or less positive parent behaviors, which will inevitably occur even in healthy parent–adolescent relationships. Such behaviors could indeed be threatening and disillusioning to the adolescent, who may be just beginning to understand their parents' flaws and faults, in turn contributing to feelings of depression and stress. Further, such accuracy could be a source of interpersonal stress that triggers an exaggerated proinflammatory response and worse inflammatory regulation. In turn, these proinflammatory tendencies could contribute to systemic inflammation over time and ultimately to the development of chronic diseases of aging (Chung et al., 2009; Nathan & Ding, 2010). Indeed, although more accurate perceptions were not significantly associated with adolescent low-grade inflammation in the present study, these proinflammatory tendencies were associated with adolescent low-grade inflammation (see Supplemental Online Materials).

This pattern of results complements prior research demonstrating that experiencing more interpersonal conflict (Miller et al., 2009), a harsh family climate (Miller & Chen, 2010), and lower perceived parental support (Miller, Gaudin, et al., 2009) are linked to similar proinflammatory tendencies. Yet these findings extend prior research by demonstrating the important role that adolescent perceptions of parental and family factors may play. Indeed, in the current study, the accuracy of adolescent perceptions was a stronger predictor of adolescent adjustment and inflammatory processes than were indicators of parent psychological adjustment and the quality of the parent–adolescent relationship, such as parental warmth and hostility (see Supplemental Online Materials).

It is also highly plausible that worse adolescent psychological adjustment promotes greater accuracy. This is in line with the concept of depressive realism (Alloy & Abramson, 1988; Lewinsohn et al., 1980), which posits that depressed mood can result in more realistic, objective perceptions of others (e.g., Kaplan, 1968), perhaps because of greater vigilance toward social threat (Allen & Badcock, 2003). Further, depressed mood promotes more analytical and systemic information processing (Chaiken, Liberman, & Eagly, 1989; Forgas & Bower, 1987; Schwarz & Bless, 1991), which could aid accuracy in this context (e.g., Biesanz & Human, 2010; Neuberg & Fiske, 1987; but see Ambady & Gray, 2002). As the current study was cross sectional, these possibilities cannot be disentangled and these effects are likely bidirectional (e.g., Overall & Hammond, 2012). Ideally, longitudinal and experimental work will shed light on the causal pathways linking these processes.

The finding that greater positivity in adolescent perceptions of parent behaviors were associated with better adolescent

psychological adjustment is perhaps less surprising, given that indicators of positive bias have long been linked to better relationship quality (Murray et al., 1996) and individual well-being (Taylor & Brown, 1988), whereas negative bias is associated with worse psychological adjustment, such as depressive symptoms (Overall & Hammond, 2012). Nevertheless, the current research extends prior work by finding similar patterns within parent–adolescent relationships. Further, although more normative and positive perceptions were linked to adolescent psychological well-being, they were not significantly associated with inflammatory processes, indicating that accuracy may play a stronger role than positivity in the biological domain within this context.

There are several limitations of the current study. First, the cross-sectional nature of the data not only limits our ability to draw causal inferences, it also means we cannot examine whether the nature of these associations may change over time or in different contexts. Indeed, just as negative behaviors in romantic relationships can sometimes have positive consequences (e.g., McNulty & Russell, 2010), accurate adolescent perceptions of parent behaviors, although potentially distressing in the short term, could have benefits over time, perhaps by triggering positive behavioral changes. Second, using outside observer ratings as the accuracy criterion could be considered both a strength and limitation. On the one hand, outside observer ratings are a valid accuracy criterion when studying observable qualities like the behaviors examined here, as opposed to more internal qualities, like thoughts and feelings, for which self-reports might be more appropriate (Vazire, 2010). However, the reliabilities of the observer ratings were not particularly high, perhaps in part because greater background information regarding the parent and the adolescent–parent relationship would be helpful in forming accurate perceptions—information that the parent, adolescent, and close-others would have better access to. Ideally, future research will examine additional accuracy criteria that were not available in this study, such as self- and close-other reports. Finally, although we propose that accurate perceptions may be detrimental because they expose adolescents to negative, relationship-threatening parent behaviors, we could not directly test this in the current study. Research that can disentangle the influence of accuracy for threatening versus non-threatening information in this context, and examine other possible mechanisms, is needed.

Overall, these findings suggest that both the accuracy and positivity of adolescent perceptions of parent behaviors may play an important role in adolescent functioning. Further, this study adds to the emerging literature linking interpersonal perceptions to biological processes of relevance to physical health (Human et al., 2014; Sanbonmatsu et al., 2011; Uchino et al., 2013) and provides the first evidence that greater accuracy can be detrimental to such processes. Future research is needed to replicate and extend these findings to other relationship contexts and psychological and biological outcomes as well as to examine the casual and mechanistic underpinnings of these associations. In sum, forming more accurate perceptions of parent behaviors may be detrimental to adolescent psychological adjustment and regulation of inflammatory processes.

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Notes

1. This article utilized the same data set as the current study but the primary variables and analyses are distinct.
2. The current sample partially overlaps with the sample utilized in Human et al. (2014). However, the current data were collected 2 years later, and accuracy assessment was different due to methodological differences. Further, there were not enough overlapping data across time points for longitudinal analyses (N_{dyads} for inflammatory analyses = 25).
3. We also examined biomarkers of low-grade inflammation; these analyses are presented in the Supplemental Online Materials.
4. A total of 112 videos were available and coded by 8 trained research assistants (RAs), but data from one of the RAs were discarded after his ratings were flagged a priori as potentially problematic, due to English language difficulties. The RA rated 18 videos, 10 of which were not double coded and therefore those videos were not included in the present analyses, resulting in a final sample of 102 coded videos. The primary effects generally remain significant or marginal with the RA's ratings included but are weaker.
5. This article involves secondary data analyses of an existing data set and therefore a priori power analyses were not conducted to determine sample size. All variables of interest to the primary questions are reported within the manuscript or Supplemental Online Materials.
6. There is not an established method for calculating effect sizes and confidence intervals for these level-1 effects. In lieu of this information, correlations and confidence intervals are provided for adolescent–observer agreement for each item (Table 1).
7. Cytokine production after exposure to lipopolysaccharide (LPS) and cortisol reflects a combination of the proinflammatory response to LPS and the anti-inflammatory response to cortisol. To further isolate the latter aspect of inflammatory regulation, we examined the ratio of proinflammatory cytokines when cells were stimulated with both LPS and cortisol versus LPS alone and found consistent but weaker effects (significant only for IL-6 and marginal for IL-8).

Supplemental Material

The supplemental online materials are available at http://spp.sagepub.com/supplemental.

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