

Associations of ambivalent leadership with distress and cortisol secretion

Raphael M. Herr¹ · Frenk Van Harreveld² · Bert N. Uchino³ · Wendy C. Birmingham⁴ · Adrian Loerbroks⁵ · Joachim E. Fischer¹ · Jos A. Bosch^{1,6}

Received: July 23, 2018 / Accepted: October 21, 2018 / Published online: October 26, 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

Abstract Ambivalent social ties, i.e., whereby a relationship is evaluated simultaneously in positive and negative terms, are a potential source of distress and can perturb health-relevant biological functions. Social interactions at the workplace, in particular with supervisors, are often described in ambivalent terms, but the psychological and psychobiological impact of such interactions has received little scientific attention. The current study examined associations between ambivalent attitudes towards one's supervisor, perceived distress (general and work-related), and diurnal dynamics of the stress hormone cortisol. 613 employees evaluated their supervisor in terms of positive and negative behaviors, which was combined into an ambivalent index. Higher ambivalence was associated with higher perceived distress and work-related stress ($p < .001$), and with a larger cortisol awakening response

and higher day-time secretion post-awakening ($p < .01$). The present study is the first to identify ambivalence towards supervisors as a predictor of employee distress and stress-related endocrine dysregulation. In consequence, focusing solely on positive or negative leader behavior may insufficiently capture the true complexity of workplace interactions and attempts to compensate negative behaviors with positive are unlikely to reduce distress—but quite the opposite—by increasing ambivalence.

Keywords Ambivalence · Supervisor · Leadership · Cortisol · Stress

Introduction

There is ample evidence that the quality of social interactions is a determinant of well-being and health (Holt-Lunstad et al., 2015; Uchino, 2006). A meta-analysis shows, for example, that poor social integration doubles mortality risk (Holt-Lunstad et al., 2010). Other forms of negative social interactions, such as bullying, disrespectful, or unfair behaviors at the workplace, likewise show pernicious effects and are major predictors of poor mental health as well as physical health and associated cardiovascular, endocrine, and inflammatory dysregulations (Herr et al., 2015a, 2015b; Ndjaboue et al., 2012; Plaisier et al., 2007; Rugulies et al., 2012).

Especially positive and negative interactions with supervisors have been shown to be a significant determinant of health and health-related outcomes. For example, the perceptions of unfair interactions, abusive supervision and destructive leadership—but also its counterparts, i.e., positive leadership styles such as transformational leadership and Leader-Member Exchange—are strongly linked to

✉ Raphael M. Herr
raphael.herr@medma.uni-heidelberg.de

¹ Mannheim Institute of Public Health, Social and Preventive Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany

² Faculty of Social and Behavioral Sciences, Social Psychology Program, University of Amsterdam, Amsterdam, The Netherlands

³ Department of Psychology and Health Psychology Program, University of Utah, Salt Lake City, UT, USA

⁴ Department of Psychology, Brigham Young University, Provo, UT, USA

⁵ Institute of Occupational, Social and Environmental Medicine, Centre for Health and Society, Faculty of Medicine, Heinrich-Heine-University of Düsseldorf, Düsseldorf, Germany

⁶ Department of Clinical Psychology, University of Amsterdam, Amsterdam, The Netherlands

physical and mental health (Harms et al., 2017; Robbins et al., 2012; Schyns & Schilling, 2013).

Interactions or supervisor behaviors are rarely solely negative *or* positive, but often are negative *and* positive (i.e., mixed). This fact is not typically reflected in how social interactions are conceived: Social interactions are typically assessed in bipolar terms, whereby opposite evaluations (e.g., unfair vs. fair) are treated as extremes on a single continuum. A recent study revealed, for example, that organizational justice and injustice are distinguishable constructs (Colquitt et al., 2015), and, in general, experiences, beliefs, or feelings towards others are not necessarily just negative or positive, but can be both at the same time; i.e., ambivalent (Cacioppo et al., 1997; Uchino et al., 2004). In the proper meaning of the word, ambivalence refers to two (*ambi*) opposing forces (*valences*) and can be generally be defined “*as simultaneously positive and negative orientations toward an object*” (Ashforth et al., 2014, p. 1454). While many of our interactions in the workplace are to some extent positive *and* negative in nature, very little is known about the consequences of such ambivalence for employee well-being.

Ambivalence might affect health and well-being by being a source of distress. It induces a cognitive state in which people have the feeling of little control and unpredictability and ambivalent persons are seen to be less foreseeable, less easily discounted or avoided, and thus to be associated with heightened interpersonal distress (Holt-Lunstad et al., 2007; van Harreveld et al., 2009). The stressful nature of ambivalence is consistent with evidence showing that ambivalence is related to elevated physiological arousal (van Harreveld et al., 2009), negative and depressed mood (Hass et al., 1992; Uchino et al., 2001), and cognitions such as a sense of victimization (e.g., Coser, 1976; Wexler, 1983). A possible further implication, then, is that ambivalence may be a risk factor for health. Indeed, Uchino and colleagues have shown that the number of ambivalent social network ties predicts health-relevant outcomes such as shorter telomeres (a biological marker of cellular aging), and the magnitude of cardiovascular responses during acute distress (Uchino et al., 2001, 2012). Likewise, spouses perceiving more ambivalent partner behavior or ties show higher blood pressure and inflammation (Birmingham et al., 2015; Uchino et al., 2013a, 2013b). Furthermore, ambivalent relationships between adults and their parents are associated with poorer psychological well-being and physical health for both (Fingerman et al., 2008), and negative health effects are also seen with ambivalent social ties among older adults (Rook et al., 2012). There is thus evidence for the notion that ambivalence can be stressful and health threatening, but as yet, little is known about such consequences of ambivalence in the workplace. Supervisors wield the power

of both reward and punishment, and are agents as well as targets of influence, and ambivalent supervisor behavior is known to lead to ambivalent attitudes of employees towards their supervisor (Pratt & Doucet, 2000). As interactions with supervisors can be a major source of employee distress (Gilbreath & Benson, 2004; Herr et al., 2015a, 2015b; Schmidt et al., 2014, 2017), and ambivalent interactions are known to be stressful (Holt-Lunstad et al., 2007; van Harreveld et al., 2015), it would seem reasonable to speculate that some supervisor-related distress may be linked to ambivalent interactions. Preliminary evidence for this idea comes from a recent study of Matta and colleagues on justice variability. In this study the authors show “that variably fair treatment was more physiologically stressful than always being treated unfairly” (Matta et al., 2017; p. 762). Based on uncertainty management theory (Lind & Van den Bos, 2002), the authors argue that justice variability represents a specific form of uncertainty—the uncertainty in fairness—which is a stressful experience (Matta et al., 2017). A similar case might be made for ambivalent leader behavior; ambivalent supervisor behavior can induce uncertainty—the uncertainty of ambivalence—which might lead to higher levels of distress, which has not been examined yet. Therefore, the aim of the current study was to assess perceptions of ambivalent supervisor behaviors (i.e., employees expressing both high positive and negative ratings of their supervisor behavior) in relation to employee psychological distress. The first hypothesis is accordingly:

Hypothesis 1a Higher levels of ambivalence towards supervisor behaviors are associated with higher ratings of general and work-related distress.

As it is currently a matter of debate whether there is something unique in the combination of positivity and negativity (i.e., ambivalence) in predicting health (Birmingham et al., 2015) or whether the association might rather be explained by the negative dimension of ambivalence (Gilligan et al., 2015) we also test the following auxiliary hypothesis:

Hypothesis 1b Associations of ambivalence towards supervisor behaviors with general and work-related distress are independent of the positive and negative component of ambivalence.

Leadership ambivalence might not only exert self-reports of psychological stress, but also physiological stress in terms of higher levels of stress hormones. Specifically, the dynamic diurnal secretion of the stress hormone cortisol is regarded a measure of prolonged stress exposure. Dysregulation of the diurnal secretion pattern of this hormone, which is regulated by the endocrine Hypothalamic–Pituitary–Adrenal (HPA) axis, is maladaptive to both

physical and mental health (McEwen, 2008; Piazza et al., 2010). The present study focused on two components of diurnal hypothalamic–pituitary–adrenal (HPA) function: The first aspect is the cortisol awakening response (CAR), which pertains to the steep cortisol increase observed within the first 30–45 min after awakening. The magnitude of this response has been proposed as a marker of (chronic) stress and negative anticipation (Clow et al., 2010; Kudielka & Wust, 2010). Second, day-time cortisol secretion was determined, i.e., cortisol release post-CAR (Edwards et al., 2001). The second hypothesis is:

Hypothesis 2a Higher levels of ambivalence towards the supervisor are positively associated with higher physiological stress levels in terms of higher cortisol levels post-awakening (CAR) and during the day (post-CAR).

Hypothesis 2b Associations of ambivalence towards supervisor behaviors with cortisol levels are independent of the positive and negative component of ambivalence.

The current study aims to contribute to the literature on organizational behavior by showing for the first time that ambivalent leadership is psychological and physiological stressful to employees. This introduces a new leadership style associated with potential adverse health effects and might guide a new field of research. Insights might also inform practice that negative behavior could not simply be compensated by positive behavior.

Method

Study population

The present study used cross-sectional data from the Mannheim Industrial Cohort Studies (MICS). The MICS comprises a cluster of studies, using largely overlapping methods and measures, that involve data collected from employees of large German manufacturing companies who participated in a voluntary employer-provided health check. The data for the current study ($n = 780$) were collected in 2007. After excluding participants with incomplete data on the main independent and dependent variables, the final sample comprised 613 participants.

Procedures

At the start of the work-day, participants completed a questionnaire and underwent a medical examination. Participants also received oral and written instructions for saliva collection at the work place and at home, together with a box containing 6 time-labelled cortisol-salivettes (polyester swab, Sarstedt, Nümbrecht, Germany) (see

details of cortisol collection below). Saliva samples were handed to the researcher on the next (work) day.

Measures

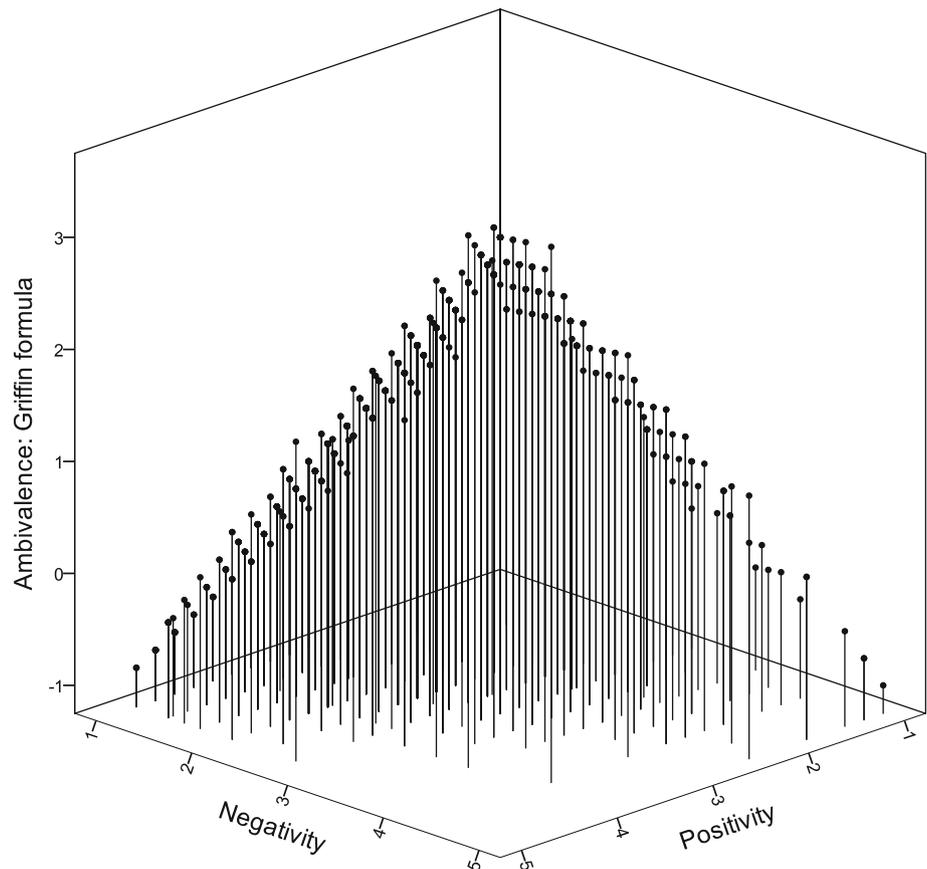
Ambivalent supervisor behavior

Positive and negative supervisor behavior was assessed by two subscales of the Salutogenetic Subjective Work Analysis questionnaire (Rimann & Udris, 1997). This questionnaire assesses burdening and supporting factors in the workplace and has been validated in several epidemiological studies (e.g., Kudielka et al., 2005; Schnorpfeil et al., 2003). Two subscales respectively assessed supportive supervisor behavior (5 items; Cronbach's $\alpha = 0.82$) and burdening supervisor behavior (3 items; Cronbach's $\alpha = 0.80$). All items (see Table 4 in Appendix) were rated on a 5-point Likert scale (ranging from “1 = does not apply at all” to “5 = fully applies”) and a score was derived by averaging the item values of the corresponding subscales. Leadership ambivalence was operationalized according to the substantiated Griffin formula (Thompson et al., 1995): $(P + N)/2 - |P - N|$, whereby P = positivity (i.e., mean of supportive behavior items) and N = negativity (i.e., mean of burdening behavior items). This formula, most widely used in research on ambivalence, takes into account that “ambivalence equals similarity of components plus intensity of components” (Thompson et al., 1995, p. 369). Consequently, ambivalence scores are higher if positivity and negativity values are simultaneously on the higher end of each scale (Fig. 1). The interpretation is different from a product term, which would quantify intensity, and an interaction term of mean-centered variables, which would quantify inconsistency (i.e., scoring high–high or low–low on the positive and negative items). Quantifying ambivalence using the Griffin formula also differentiates from a categorical approach (e.g., Birmingham et al., 2009; Uchino et al., 2001) in that it regards ambivalence as a matter of degree rather than a distinct category.

Cortisol

Instruction on the saliva collection for cortisol assessment was provided face-to-face by a member of the research team as well as through a take-home information sheet. In brief, participants were requested to place the salivette under the tongue for approximately 2 min at the prescribed times, and instructed not to brush their teeth, eat, drink (apart from water), smoke, or exercise for 30 min before each sample. On the first day of data collection, four samples were collected: before and after the examination

Fig. 1 Ambivalence scores as calculated by the Griffin formula plotted against negative and positive supervisor behavior scores; $n = 613$



(on average at around noon and 1.20 PM), at 6 PM, and before going to bed (time recorded, on average at around 10 PM). On the second day, the cortisol was assessed by three samples; immediately upon awakening, 30 min after awakening, and 120 min after waking-up.

Cortisol was analysed by Dresden Lab service (owner Professor Kirschbaum, Dresden University of Technology), using cortisol luminescence immunoassay (sensitivity, 0.008 $\mu\text{g/dl}$; percentage of intra-coefficient of variation [CV%] $\leq 4.5\%$; IBL International GmbH, Hamburg, Germany).

Three parameters assessed different aspects of the cortisol awakening response (CAR: awakening, + 30 min, + 120 min). The first CAR parameter is the peak value of the cortisol awakening response (CAR_{max}), which is the highest value of the three morning cortisol measurements, reflecting maximal adrenal activity. Second, the $\text{CAR}_{\text{AUC-G}}$ was calculated as the “area under the curve with respect to the ground”, and quantifies the total hormonal output. Third, $\text{CAR}_{\text{AUC-I}}$ was calculated as the “area under the curve with respect to increase”, which measures cortisol release relative to awakening levels and represents sensitivity of the system (Pruessner et al., 2003).

Total daytime cortisol secretion post-awakening was measured by calculating the “area under the curve with

respect to the ground” ($\text{DAY}_{\text{AUC-G}}$) using the four daytime cortisol measurements collected on the first assessment day (see above) (Halford et al., 2012).

Self-reported stress

A German translation of the four item Perceived Stress Scale (PSS-4) was used to assess general stress (Cohen et al., 1983) (Cronbach’s $\alpha = 0.60$). Work-related stress was assessed with the single-item work stress question from the INTERHEART study (IHS, Rosengren et al., 2004). This item asks if the employee is feeling irritable, anxious, or having sleeping difficulties as a result of conditions at work on a 4-point Likert scale ranging from not at all (1) to very often (4).

Confounders

Potential confounders included age (continuous), gender, lifestyle factors, and job characteristics. Lifestyle factors comprised smoking status (never smoker, ex-smoker, current smoker), alcohol consumption (average number of standard servings of beer, wine, or liquor consumed per day, transformed into gram/day), and physical exercise (no exercise, less 1 h/week, 1–2 h/week, more than 2 h/week).

Body mass index (BMI) was calculated based on height and weight assessed by trained staff. Job characteristics included job position (division manager/department manager; project leader/process manager/foreman/group leader; skilled worker/skilled employee; unskilled worker), and employment status (permanent, temporary worker).

Statistical analysis

Cortisol values were transformed (Log₁₀) and outliers, defined as values ± 3.5 SD, were removed (n ≤ 5 [0.8%]; repeating the analyses including these cases did not alter results). Continuous parameters were centralized by Z-transformation to obtain standardized regression coefficients.

Multivariate general linear models (GLM) estimated adjusted and standardized regression coefficients for the association between supervisor positivity, negativity, and ambivalence with questionnaire-based stress measures as well as with cortisol measurements. In a first step, these associations were estimated separately for supervisor positivity, negativity and ambivalence. To explore independent effects, in a second step supervisor positivity, negativity and ambivalence were included in the same model (mutual adjusted models).

Results

Table 1 provides an overview of sample characteristics. Most participants were male (91%) with an average age of 45 years, and most were skilled workers (71%) in a permanent position (96%). The ambivalence score has a mean value of 1.36, with a standard deviation of 0.97, ranges from − 1.0 to 3.53, and is evenly distributed (Fig. 1).

As shown in Table 2, bivariate correlations showed the expected associations of ambivalence, positivity, and negativity with general perceived distress (PSS-4) and overall work stress (IHS). Preliminary ambivalence was positively associated with cortisol CAR and secretion over the day.

Multivariate analyses revealed significant associations of supervisor positivity and negativity, as well as ambivalence, with questionnaire-assessed stress in separate models (*Wilk’s A* ≤ 0.97, $F_{(2,596)} ≥ 10.44$, $p < 0.001$; Table 3), confirming Hypothesis 1a. In mutual adjusted models, only the effects of positivity and negativity remained significant. In consequence, Hypothesis 1b must be rejected. Multivariate analyses of cortisol-outcomes showed only ambivalence to be a significant predictor (*Wilk’s A* = 0.98, $F_{(5,543)} = 3.46$, $p = 0.008$), also after adjustment for positivity and negativity (*Wilk’s A* = 0.97, $F_{(5,541)} = 4.59$, $p = 0.001$). Therefore, Hypotheses 2a and b are supported.

Table 1 Characteristics of the study population (n = 613)

	% or mean	n or SD
Gender, male, % n	91.0	558
Age, y, mean SD	45.1	9.5
Smoking status, % n		
Never smoker	43.6	267
Ex smoker	32.3	198
Smoker	24.1	148
Exercise, h/wk, % n		
Regularly > 2 h	29.0	178
Regularly 1–2 h	28.5	175
Regularly < 1 h/week	16.5	101
No exercise	25.9	159
Alcohol consumption, mean SD, g/d	20.4	28.1
Body mass index, kg/m ² , mean SD	24.7	3.6
Job position, % n		
Division manager/department manager	4.1	25
Project leader/process manager/foreman/group leader	20.9	128
Skilled worker/skilled employee	70.5	432
Unskilled worker	4.6	28
Employment status, % n		
Permanent	96.1	589
Temporary worker	3.9	24

Table 2 Correlations among supervisor ambivalence, positivity, negativity, self-reported stress, and cortisol measurements

	Ambivalence	Positivity	Negativity	PSS-4	IHS	CAR _{max}	CAR _{AUC-G}	CAR _{AUC-I}
Positivity	– .335***							
Negativity	.536***	– .640***						
PSS-4	.161***	– .275***	.271***					
IHS	.162***	– .204***	.276***	.398***				
CAR _{max}	.080*	– .018	– .004	– .009	.018			
CAR _{AUC-G}	.078 [§]	– .026	.020	– .030	.024	.890***		
CAR _{AUC-I}	.081*	– .048	.053	– .021	.009	.121**	.307***	
DAY _{AUC-G}	.146***	– .056	.039	.065	– .006	.268***	.313***	.192***

PSS-4 perceived stress scale, IHS INTERHEART stress at work question, CAR cortisol awakening response, AUC-G area under the curve with respect to ground, AUC-I area under the curve with respect to increase

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$; [§] $p \leq 0.1$; $n = 613$

Figure 2 represents the results of single parameter estimates (standardized regression coefficients). These analyses showed that ambivalence towards the supervisor was significantly related to distress and cortisol parameters in the separate models, except for CAR_{AUC-I} (presented in Fig. 2a; Betas ≥ 0.12 , p values ≤ 0.008). In analyses additionally controlling for positivity and negativity (presented in Fig. 2b; mutually adjusted model) ambivalent leadership remained significantly associated with cortisol dynamics, with the strongest associations seen for DAY_{AUC-G} and CAR_{max} (Betas = 0.17; p values < 0.001).

Discussion

The aim of this study was to test the relationship between ambivalent supervisor behavior and psychological and physiological stress levels. As anticipated, employees exposed to ambivalent leadership behaviors reported higher perceived distress and general work stress, and showed elevated diurnal activity of the hypothalamic–pituitary–adrenal (HPA) stress axis in terms of increased cortisol secretion. Adjustment for the effects of positive and negative supervisor behaviors (i.e., positivity and negativity) reduced the associations between ambivalence and self-reported distress, but associations with cortisol measurements remained unaltered. These findings suggest that exposure to ambivalent social interactions constitutes an independent determinant of physiological stress levels.

The present study is the first to examine ambivalent leadership behavior in relation to stress-related biology. The negative health effects of job stress have been well-established and are of a significant magnitude. For example, conventional meta-analyses and individual participant data meta-analyses [IPD-Work consortium (Dragano et al., 2017; Kivimaki et al., 2012)] show that job stress may increase coronary heart disease risk by 30% (Steptoe & Kivimaki, 2013). The current study contributes to this lit-

erature by identifying ambivalence as a novel work-related stressor with an impact on HPA-functioning. This endocrine system has been proposed as a key mediator of health effects of job stress (Brotman et al., 2007; Steptoe & Kivimaki, 2012). Whether the biological associations observed in the current study may indeed amount to damaging effects remains to be demonstrated, but arguably warrants further investigation. On that note, we may add that the effect-sizes observed here exceed those typically reported for the effects of psychosocial work stressors on HPA-functioning (Karlson et al., 2012), which is a further indication that ambivalence deserves further investigation as a source of social stress at work.

The associations of ambivalence with self-reported work stress appeared largely driven by negative supervisor behaviors. This result is in line with recent findings on the association of intergenerational ambivalence, suggesting the negative component primary responsible for the association between ambivalence and psychological well-being (Gilligan et al., 2015). This observation contrasts with cortisol dynamics, for which ambivalence was an independent predictor in this study and ambulatory blood pressure in a recent study (Birmingham et al., 2015). It is a common observation in psychobiological research that physiological markers do not map onto psychological events in a one-to-one manner, but that biological and self-report markers each convey unique information (Cacioppo & Tassinary, 1990). For example, information provided by biological outcomes is the potential health-relevant impact of a particular psychological context. Further, research on HPA-functioning has pointed at the apparent selective sensitivity of this endocrine system to social and to uncontrollable stressors. I.e., rather than non-specifically elicited by conditions that cause individuals to report distress, cortisol responses are elicited in a fairly selective manner and linked to stressors that involve uncontrollability and social threat (Dickerson & Kemeny, 2004). Thus, it may be that the aberrant HPA-functioning observed here

Table 3 Multivariate tests of single (separate models) and independent (mutual adjusted models) associations of supervisor positivity, negativity, and ambivalence with self-reported stress and cortisol measurements

	Questionnaire stress				Cortisol measurements			
	Wilk's Λ	F	df _{Error}	p value	Wilk's Λ	F	df _{Error}	p value
Separate models								
Positivity	0.92	27.25	596	<0.001	1.00	0.57	543	0.687
Negativity	0.90	33.14	596	<0.001	0.99	1.05	543	0.380
Ambivalence	0.97	10.44	596	<0.001	0.98	3.46	543	0.008
Mutual adjusted model								
Positivity	0.98	5.73	594	0.003	1.00	0.58	541	0.677
Negativity	0.98	7.59	594	0.001	0.98	2.26	541	0.061
Ambivalence	1.00	0.30	594	0.743	0.97	4.59	541	0.001

Questionnaire stress = INTERHEART stress at work question, and perceived stress scale (PSS-4). Cortisol measurements = CAR (max, AUC-G, AUC-I), and AUC-G day. n = 613. df hypothesis questionnaire stress = 2, cortisol = 4. Analyses were adjusted for age, gender, lifestyle factors (smoking status, alcohol consumption, physical exercise), BMI, and job characteristics (job position and employment status)

captures specifically these aspects, related to the inherent inconsistency and social nature of ambivalence (Baek, 2010), whereas subjectively reported distress may reflect other or additional dimensions of the stressful experience.

Another possible explanation for the observed discrepancy between the self-reports and biological stress outcomes may be related to the manner in which ambivalence was determined in the current study. I.e., ambivalence was inferred, based on a discrepancy between self-reports of positive and negative experiences, rather than assessed explicitly through self-report. Research has shown that ambivalent attitude holders can experience physiological and psychological arousal as a result of ambivalence, but are often unable to adequately attribute this arousal to their ambivalence (Nordgren et al., 2006). This unawareness about the relation between one's stress and one's ambivalence may thus additionally clarify the observation that ambivalence maps onto cortisol responses but not on self-reported distress. Subsequent research could test this possibility by investigating employees' awareness about their ambivalence and the extent to which they link this with their subjectively experienced stress, i.e., distinguishing between *objective* (i.e., potential) and *subjective* (i.e., felt) ambivalence (van Harreveld et al., 2015). It has been pointed out that objective ambivalence refers to the *existence* of conflicting associations, while subjective ambivalence taps into the (meta) *experience* of this conflict (van Harreveld et al., 2015). Measures of objective and felt ambivalence do not always correlate well (Armitage & Arden, 2007), which confirms the notion that ambivalence can either be salient (leading to an affective response) or remain in an exclusively objective state. Distinguishing between these two elements might thus help to further elucidate the differential sensitivity of HPA functioning and subjective reports to ambivalent supervisor interactions.

This study observed differences in the association of ambivalence towards supervisors with morning cortisol secretion, depending on the calculation of the cortisol awakening response (CAR). The computation of the CAR as area under the curve with respect to the ground (CAR_{AUC-G}) revealed a significant association, while the calculation as area under the curve with respect to increase (CAR_{AUC-I}) was not significantly correlated. It is thought that these outcomes capture different aspects of HPA regulation (Pruessner et al., 2003). While the CAR_{AUC-I} measures cortisol change (typically in response to a stimulus, e.g., waking up or stress) over time, indicating the sensitivity of the system, the CAR_{AUC-G} takes into account both sensitivity (the difference between measurements) and the intensity (the distance of these measures from the ground) (Fekedulegn et al., 2007; Khoury et al., 2015; Pruessner et al., 2003). According to this study, ambivalent supervisor behavior seems to be more strongly associated with the total cortisol output, than with the responsivity (i.e., change) in reaction to waking up as an eliciting stimulus.

While the present results are consistent with a detrimental role for ambivalent supervisor interactions, it has been plausibly argued that, paradoxically, ambivalent interactions (and accompanying emotional ambivalence), could also have beneficial effects (Rothman et al., 2016). For example, ambivalence towards the supervisor and among co-workers ('frenemies') may keep employees 'on edge' and fosters productive competition. Indeed, studies have linked ambivalence at the workplace to positive outcomes like enhanced creativity, better quality of decision-making, and openness to change (Fong, 2006; Rothman et al., 2016). Mechanisms by which ambivalence may exert these better outcomes are through enhancing alertness or cognitive flexibility. This, in turn, may improve the ability to collaborate, make effective decisions, and show

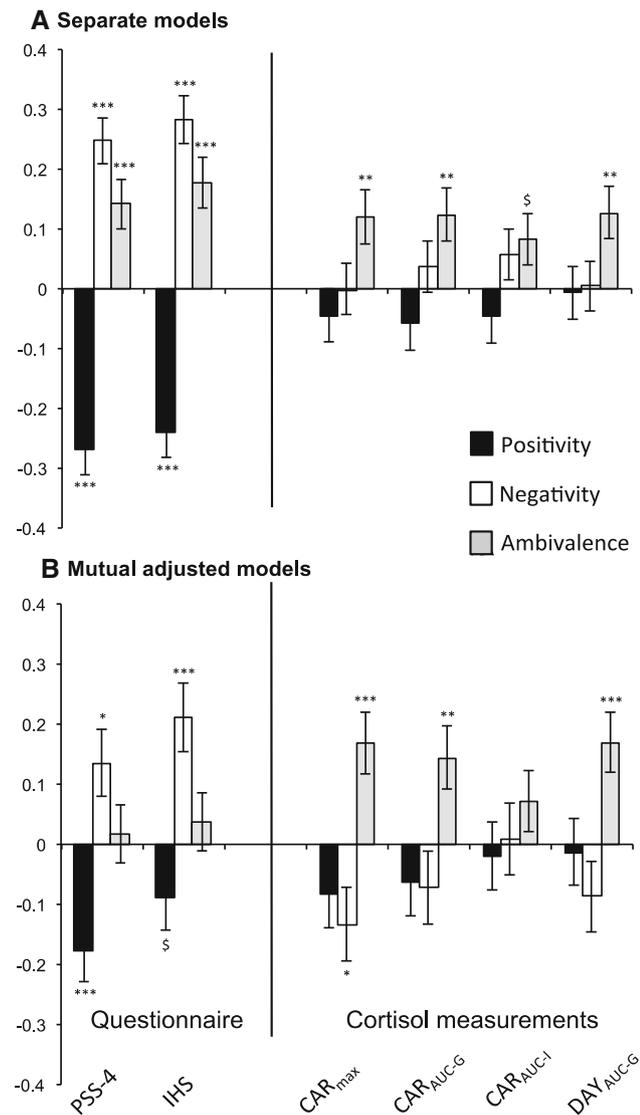


Fig. 2 Single parameter estimates of separate (a) and independent (b; after mutual adjustment for positivity, negativity, and ambivalence) associations of supervisor positivity, negativity, and ambivalence with self-reported stress and cortisol measurements. Results are expressed as standardized regression coefficients (Betas) \pm standard error. *** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$; \$ $p \leq 0.1$; $n = 613$. PSS-4 perceived stress scale; IHS INTERHEART stress at work question; CAR cortisol awakening response; AUC-G area under the curve with respect to ground; AUC-I area under the curve with respect to increase. Analyses were adjusted for age, gender, lifestyle factors (smoking status, alcohol consumption, physical exercise), BMI, and job characteristics (job position and employment status)

enhanced job performance (Methot et al., 2017; Rothman & Melwani, 2017). A possible explanation for this apparent paradox is that studies reporting positive outcomes seem to focus on parameters particularly relevant to the company (e.g., enhanced productivity), whereas the observations of the current study appear to point at the other side of this coin, i.e., possible costs to the employee in terms psycho-

logical and physiological stress. In other words, employee ambivalence may be beneficial to the company, but not to its workers, which might, however, translate in the long run into losses in terms of lost of productivity, sick leave and health care costs. In addition, it should be noted the positive effects of ambivalence at the workplace have been reported mainly for *emotional* ambivalence, while general negative effects are seen especially in research on *attitudinal* or *relational* ambivalence (Rothman et al., 2016). While emotional ambivalence addresses the simultaneous experience of positive and negative emotions, attitudinal ambivalence refers to beliefs about an object, and relational ambivalence refers to persons in a network as source of positivity and negativity (Rothman et al., 2016). Little is known (theoretically nor empirically) about how these forms of ambivalence are related or may have differential effects, and further research therefore appears appropriate.

Regarding practical implications, this study suggests that focusing solely on positive or negative leader behaviors fails to capture the complexity of interactions between supervisor and subordinate. Positive and negative aspects should be considered concurrently, and, importantly, negative leadership behavior could not be compensated by some positive behavior because this might create ambivalence, which is related to increased physiological stress levels. However, much more research is necessary to discover this new field.

The current study may have some limitations. The questionnaires measured burdening and supportive leadership behavior as positive and negative component of ambivalent leadership. Ambivalent behaviors of supervisors may, however, involve a wide range of behaviors, and the set of positive and negative behaviors sampled by the questionnaires is likely incomplete. Also, future studies may attempt a differentiation of ambivalence into specific domains (e.g., support, everyday life), which was not possible with the current data (Uchino et al., 2013). As a remaining caveat, the study sample mainly consisted of middle-aged men who were in long-term employment, which makes the generalizability of the findings to other age groups and different employment contexts uncertain. Likewise, the experiences of women in the workplace can be different than those of men, and there is evidence to suggest that female employees may place different values on and exhibit different sensitivities to social workplace interactions (Lindsey, 2015; Methot et al., 2015). Finally, this study was cross-sectional in design. Further longitudinal studies are needed to inform about the direction and causality of the relationship.

The current study provided evidence, for the first time, that ambivalent leadership behavior is associated with distress and stress-related endocrine dysregulation in terms of cortisol levels. Moreover, the associations with cortisol

dynamics were specific for ambivalence and not linked to negative leadership behavior per se, indicating that there is something unique stressful in leadership ambivalence. By implication, these findings suggest that positive behaviors do not compensate for the negative ones, but may rather enhance distress by creating ambivalence, which has important implications for practice and intervention design. Another key implication of the current study is that it challenges the idea that leadership behavior can be captured on a bipolar continuum (e.g., positive vs. negative); this measurement approach appears to belie the true complexity of work place interactions and could potentially misinform interventions. Ambivalent supervisor behavior thus warrants further investigation as a novel determinant of employee distress.

Compliance with ethical standards

Conflict of interest The authors Raphael M. Herr, Frenk Van Harreveld, Bert N. Uchino, Wendy C. Birmingham, Adrian Loerbroks and Jos A. Bosch declare that they have no conflict of interest. Joachim E. Fischer has received royalties for lectures regarding occupational health from various companies and public agents. Until 2012, Joachim E. Fischer was the CEO and a major share-holder of Health Vision GmbH.

Human and animal rights and Informed consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The ethics committee of the Manheim Medical Faculty at Heidelberg University approved this study's materials and procedures (2007-009E-MA). Informed consent was obtained from all individual participants included in the study.

Appendix

See Table 4.

Table 4 Assessment of positive and negative leadership behavior

Supportive behavior of the supervisor
The direct supervisor lets you know how well you did your work.
The direct supervisor helps me with completing the tasks.
The direct supervisor shows interest in the well-being of employees.
You can easily have access to your direct supervisor.
The direct supervisor pays attention to my opinion.
Burdening behavior of the supervisor
If a mistake is made, the supervisor puts all the blame on us, never on himself/herself.
The direct supervisor makes carrying out work difficult through instructions s/he provides.
The direct supervisor treats you unfairly.

1 = does not apply at all; 2 = does rather not apply; 3 = partially applies; 4 = largely applies; 5 = fully applies

References

- Armitage, C. J., & Arden, M. A. (2007). Felt and potential ambivalence across the stages of change. *J Health Psychol*, *12*, 149–158. <https://doi.org/10.1177/1359105307071749>
- Ashforth, B. E., Rogers, K. M., Pratt, M. G., & Pradies, C. (2014). Ambivalence in organizations: A multilevel approach. *Organization Science*, *25*, 1453–1478.
- Baek, Y. M. (2010). An integrative model of ambivalence. *The Social Science Journal*, *47*, 609–629. <https://doi.org/10.1016/j.sosoci.2010.02.003>
- Birmingham, W. C., Uchino, B. N., Smith, T. W., Light, K. C., & Butner, J. (2015). It's Complicated: Marital Ambivalence on Ambulatory Blood Pressure and Daily Interpersonal Functioning. *Annals of Behavioral Medicine*, *49*, 743–753. <https://doi.org/10.1007/s12160-015-9709-0>
- Birmingham, W. C., Uchino, B. N., Smith, T. W., Light, K. C., & Sanbonmatsu, D. M. (2009). Social ties and cardiovascular function: An examination of relationship positivity and negativity during stress. *International Journal of Psychophysiology*, *74*, 114–119. <https://doi.org/10.1016/j.ijpsycho.2009.08.002>
- Brotman, D. J., Golden, S. H., & Wittstein, I. S. (2007). The cardiovascular toll of stress. *Lancet*, *370*, 1089–1100. [https://doi.org/10.1016/s0140-6736\(07\)61305-1](https://doi.org/10.1016/s0140-6736(07)61305-1)
- Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1997). Beyond bipolar conceptualizations and measures: The case of attitudes and evaluative space. *Pers Soc Psychol Rev*, *1*, 3–25. https://doi.org/10.1207/s15327957pspr0101_2
- Cacioppo, J. T., & Tassinary, L. G. (1990). Inferring psychological significance from physiological signals. *American Psychologist*, *45*, 16–28.
- Clow, A., Hucklebridge, F., & Thorn, L. (2010). The cortisol awakening response in context. *International Review of Neurobiology*, *93*, 153–175.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385–396.
- Colquitt, J. A., Long, D. M., Rodell, J. B., & Halvorsen-Ganepola, M. D. (2015). Adding the “in” to justice: A qualitative and quantitative investigation of the differential effects of justice rule adherence and violation. *J Appl Psychol*, *100*(2), 278–294; quiz 295–277. <https://doi.org/10.1037/a0038131>
- Coser, R. L. (1976). Authority and structural ambivalence in the middle-class family. In L. A. Coser & B. Rosenberg (Eds.), *Sociological theory* (pp. 566–576). New York, NY: Macmillan.
- Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*, 355–391. <https://doi.org/10.1037/0033-2909.130.3.355>
- Dragano, N., Siegrist, J., Nyberg, S. T., Lunau, T., Fransson, E. I., Alfredsson, L., et al. (2017). Effort-reward imbalance at work and incident coronary heart disease: A multi-cohort study of 90,164 individuals. *Epidemiology*. <https://doi.org/10.1097/ede.0000000000000666>
- Edwards, S., Clow, A., Evans, P., & Hucklebridge, F. (2001). Exploration of the awakening cortisol response in relation to diurnal cortisol secretory activity. *Life Sciences*, *68*, 2093–2103.
- Fekedulegn, D. B., Andrew, M. E., Burchfiel, C. M., Violanti, J. M., Hartley, T. A., Charles, L. E., et al. (2007). Area under the curve and other summary indicators of repeated waking cortisol measurements. *Psychosomatic Medicine*, *69*, 651–659. <https://doi.org/10.1097/psy.0b013e31814c405c>
- Fingerman, K. L., Pitzer, L., Lefkowitz, E. S., Birditt, K. S., & Mroczek, D. (2008). Ambivalent relationship qualities between adults and their parents: Implications for the well-being of both

- parties. *The Journals of Gerontology: Series B*, 63, P362–P371. <https://doi.org/10.1093/geronb/63.6.p362>
- Fong, C. T. (2006). The effects of emotional ambivalence on creativity. *The Academy of Management Journal*, 49, 1016–1030. <https://doi.org/10.2307/20159814>
- Gilbreath, B., & Benson, P. G. (2004). The contribution of supervisor behaviour to employee psychological well-being. *Work & Stress*, 18, 255–266.
- Gilligan, M., Sutor, J. J., Feld, S., & Pillemer, K. (2015). Do positive feelings hurt? Disaggregating positive and negative components of intergenerational ambivalence. *Journal of Marriage and Family*, 77, 261–276. <https://doi.org/10.1111/jomf.12146>
- Halford, C., Jonsdottir, I. r. H., & Eek, F. (2012). Perceived stress, psychological resources and salivary cortisol. In M. Kristenson, P. Garvin, & U. Lundberg (Eds.), *The role of saliva cortisol measurement in health and disease* (pp. 67–86). www.benthamscience.com
- Harms, P. D., Credé, M., Tynan, M., Leon, M., & Jeung, W. (2017). Leadership and stress: A meta-analytic review. *The Leadership Quarterly*, 28, 178–194. <https://doi.org/10.1016/j.leaqua.2016.10.006>
- Hass, R. G., Katz, I., Rizzo, N., Bailey, J., & Moore, L. (1992). When racial ambivalence evokes negative affect, using a disguised measure of mood. *Personality and Social Psychology Bulletin*, 18, 786–797.
- Herr, R. M., Bosch, J. A., van Vianen, A. E., Jarczok, M. N., Thayer, J. F., Li, J., et al. (2015a). Organizational justice is related to heart rate variability in white-collar workers, but not in blue-collar workers—findings from a cross-sectional study. *Annals of Behavioral Medicine*, 49, 434–448. <https://doi.org/10.1007/s12160-014-9669-9>
- Herr, R. M., Loerbroks, A., van Vianen, A. E., Hoffmann, K., Fischer, J. E., & Bosch, J. A. (2015b). Injustice at work and leukocyte glucocorticoid sensitivity: Findings from a cross-sectional study. *Psychosomatic Medicine*, 77, 527–538. <https://doi.org/10.1097/psy.0000000000000185>
- Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspect Psychol Sci*, 10, 227–237. <https://doi.org/10.1177/1745691614568352>
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Med*, 7, e1000316. <https://doi.org/10.1371/journal.pmed.1000316>
- Holt-Lunstad, J., Uchino, B. N., Smith, T. W., & Hicks, A. (2007). On the importance of relationship quality: The impact of ambivalence in friendships on cardiovascular functioning. *Annals of Behavioral Medicine*, 33, 278–290. <https://doi.org/10.1080/08836610701359795>
- Karlsen, B., Lindfors, P., Riva, R., Mellner, C., Theorell, T. R., & Lundberg, U. (2012). Psychosocial work stressors and salivary cortisol. In M. Kristenson, P. Garvin, & U. Lundberg (Eds.), *The role of saliva cortisol measurement in health and disease* (pp. 43–66). www.benthamscience.com
- Khoury, J. E., Gonzalez, A., Levitan, R. D., Pruessner, J. C., Chopra, K., Basile, V. S., et al. (2015). Summary cortisol reactivity indicators: Interrelations and meaning. *Neurobiol Stress*, 2, 34–43. <https://doi.org/10.1016/j.ynstr.2015.04.002>
- Kivimäki, M., Nyberg, S. T., Batty, G. D., Fransson, E. I., Heikkilä, K., Alfreðsson, L., et al. (2012). Job strain as a risk factor for coronary heart disease: A collaborative meta-analysis of individual participant data. *Lancet*, 380, 1491–1497. [https://doi.org/10.1016/s0140-6736\(12\)60994-5](https://doi.org/10.1016/s0140-6736(12)60994-5)
- Kudielka, B. M., Hanebuth, D., von Kanel, R., Gander, M. L., Grande, G., & Fischer, J. E. (2005). Health-related quality of life measured by the SF12 in working populations: Associations with psychosocial work characteristics. *Journal of Occupational Health Psychology*, 10, 429–440. <https://doi.org/10.1037/1076-8998.10.4.429>
- Kudielka, B. M., & Wust, S. (2010). Human models in acute and chronic stress: Assessing determinants of individual hypothalamus-pituitary-adrenal axis activity and reactivity. *Stress*, 13, 1–14. <https://doi.org/10.3109/10253890902874913>
- Lind, E. A., & Van den Bos, K. (2002). When fairness works: Toward a general theory of uncertainty management. *Research in organizational behavior*, 24, 181–223.
- Lindsey, L. L. (2015). *Gender roles: A sociological perspective*. Abingdon: Routledge.
- Matta, F. K., Scott, B. A., Colquitt, J. A., Koopman, J., & Passantino, L. G. (2017). Is consistently unfair better than sporadically fair? An investigation of justice variability and stress. *Academy of Management Journal*, 60, 743–770.
- McEwen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European Journal of Pharmacology*, 583, 174–185. <https://doi.org/10.1016/j.ejphar.2007.11.071>
- Methot, J. R., Lepine, J. A., Podsakoff, N. P., & Christian, J. S. (2015). Are workplace friendships a mixed blessing? Exploring tradeoffs of multiplex relationships and their associations with job performance. *Personnel Psychology*, 69, 311–355.
- Methot, J. R., Melwani, S., & Rothman, N. (2017). The space between us: A social-functional emotions view of ambivalent and indifferent workplace relationships. *Journal of Management*, 0(0), 1–31. <https://doi.org/10.1177/0149206316685853>
- Ndjaboue, R., Brisson, C., & Vezina, M. (2012). Organisational justice and mental health: A systematic review of prospective studies. *Occupational and Environmental Medicine*. <https://doi.org/10.1136/oemed-2011-100595>
- Nordgren, L. F., van Harreveld, F., & van der Pligt, J. (2006). Ambivalence, discomfort, and motivated information processing. *Journal of Experimental Social Psychology*, 42, 252–258. <https://doi.org/10.1016/j.jesp.2005.04.004>
- Piazza, J. R., Almeida, D. M., Dmitrieva, N. O., & Klein, L. C. (2010). Frontiers in the use of biomarkers of health in research on stress and aging. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 65, 513–525. <https://doi.org/10.1093/geronb/gbq049>
- Plaisier, I., de Bruijn, J. G., de Graaf, R., ten Have, M., Beekman, A. T., & Penninx, B. W. (2007). The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. *Social Science and Medicine*, 64, 401–410. <https://doi.org/10.1016/j.socscimed.2006.09.008>
- Pratt, M. G., & Doucet, L. (2000). Ambivalent feelings in organizational relationships. In S. Fineman (Ed.), *Emotion in organizations* (pp. 204–226). Thousand Oaks: Sage.
- Pruessner, J. C., Kirschbaum, C., Meinschmid, G., & Hellhammer, D. H. (2003). Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology*, 28, 916–931.
- Rimann, M., & Udris, I. (1997). Subjektive arbeitsanalyse: Der Fragebogen SALSA [Subjective work analysis. The SALSA questionnaire]. In O. Strohm & E. Ulich (Eds.), *Unternehmen arbeitspsychologisch bewerten [work psychological evaluation of companies]* (pp. 281–298). Zürich: Vdf Hochschulverlag.
- Robbins, J. M., Ford, M. T., & Tetrick, L. E. (2012). Perceived unfairness and employee health: A meta-analytic integration. *Journal of Applied Psychology*, 97, 235–272. <https://doi.org/10.1037/a0025408>
- Rook, K. S., Luong, G., Sorkin, D. H., Newsom, J. T., & Krause, N. (2012). Ambivalent versus problematic social ties: Implications

- for psychological health, functional health, and interpersonal coping. *Psychology and Aging*, 27, 912–923. <https://doi.org/10.1037/a0029246>
- Rosengren, A., Hawken, S., Ounpuu, S., Sliwa, K., Zubaid, M., Almahmeed, W. A., et al. (2004). Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (the INTERHEART study): Case-control study. *Lancet*, 364, 953–962. [https://doi.org/10.1016/s0140-6736\(04\)17019-0](https://doi.org/10.1016/s0140-6736(04)17019-0)
- Rothman, N., & Melwani, S. (2017). Feeling mixed, ambivalent, and in flux: The social functions of emotional complexity for leaders. *Academy of Management Review*, 42, 259–282.
- Rothman, N., Pratt, M., Rees, L., & Vogus, T. (2016). Understanding The Dual Nature of Ambivalence: Why and When Ambivalence Leads to Good and Bad Outcomes. *Academy of Management Annals*, 10(1), 0066.
- Rugulies, R., Madsen, I. E. H., Hjarsbech, P. U., Hogh, A., Borg, V., Carneiro, I. G., et al. (2012). Bullying at work and onset of a major depressive episode among Danish female eldercare workers. *Scandinavian Journal of Work, Environment & Health*, 38, 218–227.
- Schmid, J. A., Jarczok, M. N., Sonntag, D., Herr, R. M., Fischer, J. E., & Schmidt, B. (2017). Associations between supportive leadership behavior and the costs of absenteeism and presenteeism: An epidemiological and economic approach. *Journal of Occupational and Environmental Medicine*, 59, 141–147. <https://doi.org/10.1097/jom.0000000000000919>
- Schmidt, B., Loerbroks, A., Herr, R. M., Wilson, M. G., Jarczok, M. N., Litaker, D., et al. (2014). Associations between supportive leadership and employees self-rated health in an occupational sample. *Int J Behav Med*, 21, 750–756. <https://doi.org/10.1007/s12529-013-9345-7>
- Schnorpfeil, P., Noll, A., Schulze, R., Ehlert, U., Frey, K., & Fischer, J. E. (2003). Allostatic load and work conditions. *Social Science and Medicine*, 57, 647–656.
- Schyns, B., & Schilling, J. (2013). How bad are the effects of bad leaders? A meta-analysis of destructive leadership and its outcomes. *The Leadership Quarterly*, 24, 138–158. <https://doi.org/10.1016/j.leaqua.2012.09.001>
- Stephoe, A., & Kivimaki, M. (2012). Stress and cardiovascular disease. *Nat Rev Cardiol*, 9, 360–370. <https://doi.org/10.1038/nrcardio.2012.45>
- Stephoe, A., & Kivimaki, M. (2013). Stress and cardiovascular disease: An update on current knowledge. *Annual Review of Public Health*, 34, 337–354. <https://doi.org/10.1146/annurev-publhealth-031912-114452>
- Thompson, M. M., Zanna, M. P., & Griffin, D. W. (1995). Let's not be indifferent about (attitudinal) ambivalence. *Attitude strength: Antecedents and consequences*, 4, 361–386.
- Uchino, B. N. (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, 29, 377–387. <https://doi.org/10.1007/s10865-006-9056-5>
- Uchino, B. N., Bosch, J. A., Smith, T. W., Carlisle, M., Birmingham, W., Bowen, K. S., et al. (2013a). Relationships and cardiovascular risk: Perceived spousal ambivalence in specific relationship contexts and its links to inflammation. *Health Psychology*, 32, 1067–1075. <https://doi.org/10.1037/a0033515>
- Uchino, B. N., Cawthon, R. M., Smith, T. W., Light, K. C., McKenzie, J., Carlisle, M., et al. (2012). Social relationships and health: Is feeling positive, negative, or both (ambivalent) about your social ties related to telomeres? *Health Psychology*, 31, 789–796. <https://doi.org/10.1037/a0026836>
- Uchino, B. N., Holt-Lunstad, J., Smith, T. W., & Bloor, L. (2004). Heterogeneity in social networks: A comparison of different models linking relationships to psychological outcomes. *Journal of Social and Clinical Psychology*, 23, 123–139.
- Uchino, B. N., Holt-Lunstad, J., Uno, D., & Flinders, J. B. (2001). Heterogeneity in the social networks of young and older adults: Prediction of mental health and cardiovascular reactivity during acute stress. *Journal of Behavioral Medicine*, 24, 361–382.
- Uchino, B. N., Smith, T. W., Carlisle, M., Birmingham, W. C., & Light, K. C. (2013b). The quality of spouses' social networks contributes to each other's cardiovascular risk. *PLoS ONE*, 8, e71881. <https://doi.org/10.1371/journal.pone.0071881>
- van Harreveld, F., Nohlen, H. U., & Schneider, I. K. (2015). The ABC of ambivalence: Affective, behavioral, and cognitive consequences of attitudinal conflict. In M. O. James & P. Z. Mark (Eds.), *Advances in experimental social psychology* (Vol. 52, pp. 285–324): Cambridge: Academic Press.
- van Harreveld, F., Rutjens, B. T., Rotteveel, M., Nordgren, L. F., & van der Pligt, J. (2009a). Ambivalence and decisional conflict as a cause of psychological discomfort: Feeling tense before jumping off the fence. *Journal of Experimental Social Psychology*, 45, 167–173. <https://doi.org/10.1016/j.jesp.2008.08.015>
- van Harreveld, F., van der Pligt, J., & de Liver, Y. N. (2009b). The agony of ambivalence and ways to resolve it: Introducing the MAID model. *Personality and Social Psychology Review*, 13, 45–61.
- Wexler, P. (1983). *Critical social psychology*. London: Routledge & Kegan Paul.