

*A breath of toxic air: the relationship between appraised air pollution, abusive supervision and laissez-faire leadership through the dual-mediating pathways of negative affect and somatic complaints*

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A Breath of Toxic Air: The Relationship Between Appraised Air Pollution, Abusive Supervision and Laissez-Faire Leadership through the Dual-Mediating Pathways of Negative Affect and Somatic Complaints

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## Abstract

Air pollution has become a global public health hazard leading to debilitating effects on physical, mental, and emotional health. Management research has just begun to explore the effects of air pollution on employees' work life. Drawing from the transactional theory of stress (Lazarus & Folkman, 1984) and crossover theory (Westman, 2001), we argue that appraisal of air pollution is an important factor that influences leaders and their behavior with subordinates. Specifically, we propose that when leaders appraise severe air pollution, they are more likely to behave abusively toward their subordinates and engage in laissez-faire leadership. We also propose that this relationship is mediated by leaders' experience of somatic complaints and negative affect. We test our model using an experience sampling study in India of leaders and followers who were located in different cities from each other. Overall, our results highlight how air pollution appraisals can harm not only the leader experiencing the pollution, but also subordinates of those leaders. In other words, our counterintuitive finding is that subordinates may be harmed by air pollution to which they are not even directly exposed.

*Keywords:* Air Pollution, Somatic Complaints, Affect, Abusive Supervision, Laissez-Faire Leadership

Air pollution levels have been rising at a startling rate. Between 1960 and 2009, fine particulate matter (PM 2.5, a leading source of air pollution) rose 38% around the world (Butt et al., 2017). Fifty-five percent of the global population had higher exposure to PM 2.5 in 2016 than in 2010 (Shaddick et al., 2020). With an increase in global average temperatures, it is predicted that common air pollutants, such as ozone, will have greater concentrations resulting in worsening air quality (Orru et al., 2017). Due to this increase in the prevalence of elevated levels of air pollution, many more people around the world now have greater exposure to toxic air during their work than they did even a decade ago. Chronic exposure to air pollution can have debilitating effects such as birth defects, developmental delays, and reduced activity of the immune system (Kampa & Castanas, 2008). However, even short term exposure can have harmful physiological and psychological impairments (Braithwaite et al., 2019).

Researchers in the organizational behavior literature have begun to give attention to air pollution as an environmental factor that influences people at work. For example, Fehr et al. (2017) found that when employees appraise air pollution, they engage in less organizational citizenship and more counterproductive work behavior. Gong et al. (2020) found that air pollution appraisals predicted unethical behavior due to increased anxiety. This stream of research has demonstrated that beyond objective air pollution, the psychological experience of air pollution is also an important influence on employee outcomes.

Although this groundbreaking research is important, it has focused largely on how air pollution impacts an employee's own experience and perceptions at work. The outcomes examined by Fehr et al. (2017) and Gong et al. (2020) have implications not only for the focal employees themselves but also for crossover experiences of fellow employees. However, these aspects have been treated as ancillary side effects rather than central to the behaviors themselves. This is especially relevant in the context of leadership, in which leader behaviors toward subordinates are directly intertwined with the experiences of those subordinates (Howell &

Shamir, 2005) and can thus cross over to their experiences as well. A crucial step in the development of this literature is the examination of leader behaviors toward subordinates. Therefore, in this paper, we aim to study how air pollution appraised by leaders can cross over into the experience of their followers.

Thus, in this paper we integrate crossover theory (Westman, 2001) with the transactional theory of stress (Lazarus & Folkman, 1984) to examine how air pollution appraised by leaders can cross over to follower experiences of abusive supervision and laissez-faire leadership. We propose that when leaders appraise heavy air pollution, they experience emotional and physical strain which crosses over to subordinates in the form of negative leadership behaviors. To test this model, we conducted a daily diary study involving leaders and followers in India who worked remotely from different cities. In other words, our counterintuitive assertion is that subordinates may be harmed by air pollution to which they are not even directly exposed. Our theoretical model is represented in Figure 1. Our results highlight how air pollution harms not only the leaders experiencing the pollution, but also their subordinates.

This research makes several contributions. First, by integrating crossover theory with the transactional theory of stress, we broaden the literature on destructive leadership by demonstrating the role of air pollution appraisals as antecedents of leaders' abusive and laissez-faire behavior towards their followers. The literature on destructive leadership has focused on work-related antecedents of leaders' negative behaviors (Mackey et al., 2017; Mawritz et al., 2012; Tepper et al., 2011), but our work demonstrates the role of physical environmental factors such as air pollution in driving such behavior. Second, our study shows how leaders' air pollution appraisals can cross over to influence follower outcomes even through remote work arrangements. As remote work becomes increasingly common and climate change accelerates the intensity and variability of air pollution worldwide (Gallup Inc, 2021; Huang et al., 2017), 2017), this finding has important implications for considering how leaders' relationship with

their subordinates is influenced by the range of physical environmental factors in multiple geographical areas in which they are based. This study also suggests that leaders' negative affect and somatic complaints are two pathways that link air pollution appraisals and leader behaviors. By examining two theory-informed pathways, our work offers a broad base for future research on climate change and work outcomes to draw upon. Third, we contribute to the literature on air pollution and work by showing that employees can be vulnerable to air pollution to which they are not directly exposed to themselves. Specifically, we show that in remote-work environments, followers experience more abuse and laissez-faire behavior from their leaders when those leaders appraise air pollution in their environment. This is important because it suggests that the costs of air pollution on work outcomes might be more pronounced than previously thought.

### **Theory and hypotheses**

In this paper, we draw from the transactional theory of stress (Lazarus & Folkman, 1984) and crossover theory (Westman, 2001) to posit that air pollution is a harmful workplace stressor that can influence important leader outcomes. Specifically, we posit that appraised air pollution can strain leaders physically and affectively, and can influence their behavior toward their followers. According to the transactional theory of stress (R. Lazarus & Folkman, 1984), an event is experienced as a stressor depending on how it is appraised. During the primary appraisal process, a cognitive evaluation is made on whether the situation or event is threatening or harmful. Then, the secondary appraisal process ensues in which an evaluation is made on whether the individual has resources to prevent the harm or loss. We argue that when leaders experience air pollution, they are likely to appraise it as threatening and harmful, especially as severe air pollution can manifest in the form of dense smog that is detrimental to health (Zhang et al., 2017).

According to the transactional theory of stress (Lazarus & Folkman, 1984), when individuals appraise situations as stressful, there are three key dimensions of outcomes that are

affected: morale (affect), somatic health, and social functioning (Lazarus & Folkman, 1984). Morale (affect) refers to “affect a person experiences during and after an encounter” (p. 183), whereas somatic health refers to changes in physical health. Social functioning encompasses the effectiveness with which a person fulfills his or her daily responsibilities towards others. Drawing on these three dimensions of the transactional theory of stress, we study how air pollution appraisals relate to somatic complaints (somatic health), negative affect (morale), and leadership behaviors (social functioning).

Existing research has documented detrimental effects of exposure to air pollutants on human health and well-being (Braithwaite et al., 2019; Kuo et al., 2006; Nawrot et al., 2006; Tager et al., 2005). Based on the transactional theory of stress, we posit that even the subjective appraisal of air pollution (holding the objective level of air pollutants in the air constant) may influence people’s well-being outcomes. Lazarus and Folkman (1984) note that much of the effect of stressors on strain outcomes occurs through the appraisal process which drives downstream psychological and behavioral effects. This process is imperfect, such that people may make appraisals about pollution which are not entirely aligned with actual pollution level. However, objective pollution tends to correlate moderately with pollution appraisals (Fehr et al., 2017; Gong et al., 2020).

Research has found that air pollution appraisals are associated with strain on both physical as well as psychological functioning. For example, Fehr et al. (2017) found that air pollution appraisals were associated with a loss of self-control resources. Similarly, research has found that air pollution appraisals can lead people to feel more anxiety about their health and future (Sass et al., 2017). Thus, existing research has uncovered a relationship between air pollution appraisals and psychological well-being, which is an important first step toward a crossover model which is more socially focused.

Stress appraisals affect both somatic health and affective responses which play a crucial

role in enabling people to function in social settings (DeLongis et al., 1988; Gucht et al., 2003; Kawano, 2008; Spector, 1987). A key tenet of the transactional theory of stress is that social functioning is a function of a person's environment and that stressors in an environment can alter how people experience and express relationships (Lazarus & Folkman, 1984, p. 184). Extensions to the transactional theory of stress indicate that affect and somatic complaints are antecedents to social functioning and mediate the relationship between stressors and behavioral changes at work (Cho & Kim, 2022; DeCelles et al., 2019; Wagner et al., 2014). This suggests that somatic complaints and affect play a key role in behaviors that leaders engage in with subordinates.

Stressors can prompt withdrawal behavior and “defensive operations” that turn a person inward, and can also encourage hostility and aggression, both of which hinder effective social functioning (Lazarus & Folkman, 1984, p. 191). Past research has demonstrated that air pollution is associated with avoidant behaviors such absenteeism and presenteeism, and shirking of interactions with people (Chang et al., 2016; Hansen & Selte, 2000; Ostro, 1983), as well as approach behaviors such as violent and property crime and unethical behavior (Lu et al., 2018; Nevin, 2000). This suggests that when leaders appraise high air pollution, their set of negative responses can be both confrontational and avoidant. A confrontational response for a leader can include hostility and aggressive behaviors towards others (i.e., abusive supervision), whereas an avoidance-based response can mean withdrawing and retreating from leadership responsibilities (i.e., laissez-faire leadership).

According to crossover theory, the experiences of one person can affect the experiences of another (Westman, 2001)—in our case from leaders to subordinates. Crossover involves transmission across individuals, whereby demands and their consequent strain cross over between closely related persons (Westman, 2002). By integrating crossover theory with the transactional theory of stress (Lazarus & Folkman, 1984), we propose that the physical and emotional strain experienced by leaders can cross over to the experience of followers in the form

of abusive supervision and laissez-faire leadership. Therefore, we propose:

*H1: Leader air pollution appraisals are positively associated with laissez-faire leadership.*

*H2: Leader air pollution appraisals are positively associated with abusive supervision.*

## **Mediating Mechanisms**

### ***Air Pollution Appraisals and Leader Somatic Complaints***

Lazarus and Folkman (1984) identify somatic health as an outcome of stress appraisals.

Somatic complaints are discrete physiological experiences, such as coughing or pain, that originate within a person (Pennebaker, 2012; Spector, 1987). Stress appraisals trigger changes in both behavior and the body that can increase the general risk of illness driven by neurochemical stress reactions (Lazarus & Folkman, 1984). Evidence from neuroimaging has shown that appraisal processes in the brain after exposure to stressors originate in the same part of the brain that control physiological reactions in the body (Gianaros & Wager, 2015). When people experience stress, the two endocrine systems that are particularly reactive are the hypothalamic-pituitary-adrenocortical axis (HPA) and the sympathetic-adrenal-medullary (SAM) system. Frequent activation of the HPA and SAM systems can result in an increased risk for physical and psychiatric disorders (McEwen, 1998). This is consistent with previous research on occupational health safety that shows that air quality is an occupational hazard that is associated with physical, emotional, and social strain such as negative affect, substance use, hypertension, inflammation, and changes in heart rate (Bakke et al., 2007; Biron et al., 2011; Leiter & Harvie, 1997).

Workplace stressors have previously been linked with health problems. Experiencing injustice and incivility in the workplace is associated with difficulties sleeping (Greenberg, 2006; Niedhammer et al., 2009). Meier et al. (2013) found a link between relationship conflict and somatic complaints. Workplace stress is also associated with presence of cortisol, inflammation, and metabolic syndrome (Almadi et al., 2013). In sum, we argue that when leaders appraise high air pollution in their environment, they are likely to experience somatic complaints.

*H3: Leader air pollution appraisals are positively associated with leader somatic complaints.*

### ***Air Pollution Appraisals and Leader Negative Affect***

When individuals experience stressors, they also have affective reactions to those situations (Lazarus & Folkman, 1984). Stressors can induce negative feelings because they can indicate threat to the current state of self and/or harm to desirable goals and states (Crawford et al., 2010; R. S. Lazarus, 1991; Lepine et al., 2005). Appraising air pollution as being severe can pose a threat to employees' health and performance and can lead to negative affective states. In line with this notion, past research has shown that when employees perceive stressors as hindrance stressors, they experience more anxiety, anger, and distress (Lim & Tai, 2014).

Research has shown that air pollution is negatively associated with people's mood. For instance, research has found that air pollution is associated with negative affect and depressive mood (Nuysts et al., 2019; Zijlema et al., 2016). Gong et al. (2020) found that air pollution appraisals were associated with an increase in feelings of anxiety. Air pollution appraisals lead to negative emotions such as anger and anxiety because they threaten achieving one's basic goal of maintaining physical and social health. Therefore, we propose:

*H4: Leader air pollution appraisals are positively associated with leader negative affect.*

### **Somatic Complaints and Leadership**

We posit that leaders experiencing somatic complaints due to appraisals of air pollution will have a decrement in their social functioning as leaders. A leader who experiences somatic complaints faces diminished social effectiveness compared to someone who is healthy (Lazarus & Folkman, 1984). We suggest that experiencing somatic complaints will affect both confrontational (abusive) and avoidance (laissez-faire) reactions of leaders towards subordinates.

Laissez-faire leadership is a passive form of leadership that entails leader inaction and avoidant behaviors (Bass, 1985). Laissez-faire leaders avoid taking decisions, hesitate to get involved in their duties towards their followers, and are not present when needed. Research has generally supported the idea that this form of passive leadership is associated with negative

outcomes for both the leader and the subordinates (Hinkin & Schriesheim, 2008; Skogstad et al., 2007). A person experiencing somatic complaints has less energy to expend on effective social functioning than a person who is healthy (Lazarus & Folkman, 1984). Past research has shown that when people experience physical discomfort, they are likely to engage in threat-avoidance reactions (Eccleston & Crombez, 1999) that propel them to withdraw from normal activities (Hamilton et al., 2004), and are likely to direct more energy toward pain management and less toward their work roles which can result in low levels of engagement (Eccleston & Crombez, 1999). Research has also found that individuals who suffer from poor somatic health tend to engage in withdrawal, inaction, and avoidance (Compas et al., 2001; Connor-Smith & Flachsbart, 2007). In the context of leadership, a reduction in energy due to somatic complaints may be associated with lower work engagement with their duties towards their followers, manifested as higher laissez-faire leadership. Therefore, we propose:

*H5a: Leader somatic complaints mediate the positive association between leader air pollution appraisals and laissez-faire leadership.*

Abusive supervision is a leader's display of verbal and nonverbal hostility toward their followers, excluding physical contact (Tepper, 2000). When people experience somatic complaints, such as pain, there is an increase in abnormal blood flow and activity in the prefrontal cortex (Geha et al., 2007; Staud & Domingo, 2001), both of which are physiological indicators of impaired brain function (Apkarian et al., 2004). Pain also increases cortisol levels (Korszun et al., 2000, 2002), which can reduce energy and thereby increase the chance of negative behaviors such as abusive supervision. In support of this, previous research has shown that when leaders experience suboptimal physical health, they can behave aggressively and rudely with their followers (Barnes et al., 2015). Similarly, research has shown that when employees experience pain during their work, they can engage in more counterproductive work behaviors (Christian et al., 2015) because of a reduction in cognitive energy (Turk & Rudy, 1986). Therefore, we propose:

*H5b: Leader somatic complaints mediate the positive association between leader air pollution*

*appraisals and abusive supervision.*

### **Negative Affect and Leadership**

When individuals appraise stress, they also experience negative affect that influences their social functioning (Lazarus & Folkman, 1984). Affective experiences are associated with different action tendencies, which are impulsive and automatic urges to achieve certain goals (Frijda, 1994). For negative affect, the action tendency is to improve the current situation by trying to avoid or change it. This can be done through avoidance of the situation or through attempts to engage in actions to change the situation.

In the context of an avoidance of leadership, we suggest that on days in which leaders experience negative affect, they will engage in more laissez-faire behavior. When individuals experience negative moods, one of the responses is to withdraw in order to avoid the situation (Lazarus & Folkman, 1984). Scott and Barnes (2011) found that when employees experienced negative affect, they were more likely to engage in work withdrawal. Similarly, in a meta-analysis, researchers found that negative affect was related to work withdrawal behaviors (Kaplan et al., 2009). There is also evidence that when subordinates rate their leaders as having higher negative affect, they also attribute higher laissez-faire behavior (Zineldin & Hytter, 2012).

Therefore, we propose:

*H6a: Leader negative affect mediates the positive association between leader air pollution appraisals and laissez-faire leadership.*

We argue that negative affect will also enhance the confrontational responses that leaders engage in after appraising air pollution. According to Lazarus (1991), people can engage in deviant behaviors as an active form of behavior in response to negative affect. Research has shown that negative affect leads to counterproductive behaviors (Geen & Quanty, 1977). Engaging in abusive supervision in response to negative affect may be a means to seek catharsis (Koopman et al., 2020). Emotion theories suggest that highly activated negative affect provides more energy to exert an influence because of elements of potency and action readiness (Russell, 2003; Shaver et al., 1987). Research has shown that negative affect is associated with negative

workplace behaviors (Koopman et al., 2020). Several studies in the emotions literature have found a robust link between feeling negative emotional states and aggressive behavior (for example, Leger et al., 2018). In fact, previous research has found support that negative affect is an important antecedent of abusive supervision (Hoobler & Hu, 2013). Thus, we propose: *H6b: Leader negative affect mediates the positive association between leader air pollution appraisals and abusive supervision.*

## Methods

This study was reviewed and approved under study name ‘Daily Air Pollution Study’ under Henley Business School, University of Reading Ethics Approval.

### Research Context

We collected our data in India. Air pollution in India resulted in 1.67 million deaths in 2019 (17.8 percent of all deaths in the country)—the largest pollution-related death toll in the world (Pandey et al., 2021). In fact, a study conducted by the World Health Organization found that 14 of the 15 leading cities in terms of PM2.5 concentration were in India (Guttikunda et al., 2019; WHO, 2018b). Exposure to air pollution has become a source of constant anxiety, fear, and frustration for hundreds of millions of people in India, especially in the winter months when the air turns into thick smog. According to newspaper reports (Gardiner, 2015; Wu et al., 2020), for millions of people working outdoors or travelling to work in the morning, air pollution is often described as a torture where “every day feels like a punishment” (Kumar & Schmall, 2021). In a newspaper report an employee described her ordeal as follows: “These last three weeks...I was so sick that I couldn’t take it anymore” (Kumar & Schmall, 2021).

### Participants and Procedure

Given our interest in exploring the crossover of leader appraisals of air pollution on follower experiences of active and passive forms of negative leadership, we used a daily diary design. We collected data over ten consecutive workdays. This included leaders and their followers in various organizations from seven Indian states and twelve cities. We recruited work

groups in which leaders and subordinates were geographically dispersed (i.e., working remotely from different cities) to empirically demonstrate that leader pollution appraisals have an effect beyond subordinate appraisals of pollution. Leaders worked remotely with their followers either while working from home or from their work office. Participants were contacted through alumni groups and one of the author's personal contacts. Participants came from a wide variety of industrial backgrounds such as accounting and finance, telecommunications, IT, fertilizers, and manufacturing. Leaders and followers interacted on a daily basis using platforms such as Zoom and Google Meet, giving them ample opportunities to observe each other's behaviors. Registered participants received email notifications to complete one baseline survey followed by end-of-work daily surveys for ten consecutive workdays. Surveys were conducted in English.

We originally contacted 565 leaders to participate in our research. We identified potential leaders as those who had other employees directly reporting to them. One hundred leaders agreed to participate in our research (a response rate of 18%). We then asked them to share a roster with information regarding their followers. On average, each leader had 8.29 followers. From this list, we randomly selected three followers per leader and requested them to participate in the study. Sixty-six leaders (66% response rate) and 182 followers (61% response rate) started our surveys. From these 66 leaders, we received 591 data points out of a possible 660 for a response rate of 90%. For subordinates, we received 1,763 data points out of possible 1,820 responses resulting in a 97% response rate. We only retained leaders and followers for whom we had at least three days of data. We removed any responses in which leader and subordinate data could not be matched. Ultimately, we were left with 569 daily leader surveys from 58 leaders and 1,714 daily follower surveys. Participants were paid with grocery vouchers worth Rs 1200 (USD 15) for completing at least seven daily surveys. See Table 1 for participant demographics.

### **Transparency and Openness**

We describe our sampling plan and measures in the study, and we adhered to the Journal of

Applied Psychology methodological checklist. Data, analysis code, and materials are available at [https://researchbox.org/492&PEER REVIEW\\_passcode=QQDFSW](https://researchbox.org/492&PEER REVIEW_passcode=QQDFSW). Data were analyzed using Mplus version 8.7 (L. K. Muthén & Muthén, 2017). This study's design and analysis were not preregistered.

## Measures

**Daily Air Pollution Appraisals** (within-person  $\omega = .65$ ).<sup>1</sup> Leaders rated their air pollution appraisals using the following four items from the scale developed by Fehr et al. (2017): “Today, the air pollution was (a) severe, (b) bad, (c) extreme, (d) unbearable.”

**Daily Leader Negative Affect** (within-person  $\omega = .81$ ). We used the following five items from the PANAS-X Scale (Watson et al., 1988): “upset, nervous, distressed, jittery, and irritable.”

**Daily Leader Somatic Complaints** (within-person  $\omega = .78$ ). We measured leader somatic complaints by asking leaders the extent to which they felt the following three common somatic complaints associated with air pollution (US EPA, 2016; WHO, 2018a) that day: (a) difficulty breathing, (b) irritation in my eyes, and (c) a cough.

**Daily Laissez-Faire Leadership** (within-person  $\omega = .88$ ). Followers rated the laissez-faire leadership of their leaders using four items from the laissez-faire scale (Bass & Avolio, 1996). A sample item is, today my leader “avoided getting involved when important issues arose.”

**Daily Abusive Supervision** (within-person  $\omega = .86$ ).<sup>2</sup> Followers rated the abusive supervision of their leaders using five items of the abusive supervision scale (Barnes et al., 2015; Tepper, 2000). Sample items include, today my leader, “started an argument with a work group member”, “made fun of a work group member”, and “ignored a work group member.”

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<sup>1</sup> To rule out self-generated range restriction due to items used in the study, we conducted a validation study on Prolific Academic in which we included two additional items (“fine”, “not a problem”) in addition to the items used for that scale in our main study. Results revealed a high degree of overlap between this extended scale and the original scale,  $r = 0.80$ ,  $p < 0.01$ .

<sup>2</sup> Although there are exceptions (Barnes et al., 2015; Foulk et al., 2018; Johnson et al., 2012), research on abusive supervision uses items in which subordinates rate abuse directed towards themselves. To test whether our scale was conceptually similar to the original scale, we conducted a study on Prolific Academic in which 100 employees who reported to a supervisor reported their supervisor's abuse toward them and toward group members in general (using the same 5 items). The correlation between the two scales was 0.85, which gave us confidence that the scale we used for our study which makes reference to the victim as someone in the workgroup is conceptually similar to traditional scales which reference the self as victim.

**Control Variables**<sup>3</sup> We controlled for daily follower air pollution appraisals ( $\omega = 0.77$ ), because follower ratings of their leader behaviors could be influenced by their own appraisal of air pollution. We also controlled for daily objective air pollution (measured by AQI) using data from the weather station closest to the leader. We also controlled for daily leader workload ( $\omega = 0.71$ ) as well as leader's daily commute to work (2=Yes), as these variables are likely to influence air pollution appraisals as well as leadership behaviors. Lastly, we controlled for day of the study as well as day of the week to rule out self-generated validity concerns. Results without control variables can be found in Table 2. Results with control variables can be found in the Appendix.

### **Analytical Strategies**

For hypotheses testing, we performed multilevel path analysis (Preacher et al., 2010). We modeled all effects as fixed slopes. We used Bayesian estimation to conduct our analysis (Yuan & MacKinnon, 2009). The use of Bayesian estimation allows for appropriately estimated models that are complex, computes accurate confidence intervals for non-normally distributed indirect effects, and provides directly interpretable findings based on observed data (Kruschke et al., 2012; B. Muthén, 2010; Simon et al., 2015; Zyphur & Oswald, 2013). We followed guidelines by Preacher, Zyphur, and Zhang (2010) to conduct multilevel mediation analysis using Bayesian estimation (Ng & Yam, 2019) using latent-mean centering. Statistical significance for our analysis was inferred from 95% credibility intervals that did not contain 0.

As the independent and mediating variables had two levels of variation (leader days nested within leaders), but the dependent variables had three levels of variation (subordinate days nested within leader days nested within leaders), we aggregated across follower reports of abusive supervision and laissez-faire leadership of a given to the leader day level. For daily abusive supervision,  $ICC(1) = .80$  and  $ICC(2) = .92$ . For daily leader laissez-faire leadership,  $ICC(1) = .45$  and  $ICC(2) = .71$ . These values exceed the recommended cutoffs for aggregation

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<sup>3</sup> It is possible that between-leader variance in somatic complaints influenced the relationship between air pollution appraisals and daily somatic complaints. Although we did not have data for baseline leader somatic complaints, we aggregated daily somatic complaints for each leader to create a proxy for chronic somatic complaints. We then controlled for this at Level 2. Our results do not meaningfully change when we add this control.

(Bliese, 1998) and support aggregation of daily subordinate ratings to the daily leader level.

## Results

To examine the appropriateness of multilevel modeling for our analyses, we partitioned the variance of each variable into within-leader and between-leader levels. We found that 34.7% of the variance in abusive supervision and 64.1% of the variation in laissez-faire leadership was within leaders. This suggests that these two leader behaviors varied significantly across measurement occasions (days). In addition, 42.3% of the variation in somatic complaints, 77.7% of the variation in negative affect, and 63.7% of the variation in leader air pollution appraisals was within leaders. This also suggests that a substantial portion of the variation in these variables was at the day level, which is not only consistent with our hypotheses, but which also justifies our decision to use a multilevel daily diary design with day-level responses.

## Hypothesis Testing

Descriptive statistics and correlations are presented in Table 1. Model results are presented in Table 2<sup>4</sup>. In support of H1, we found a positive relationship between air pollution appraisals and laissez-faire leadership ( $b = .14$ ,  $PSD = .02$ , CI [.09, .18]). In support of H2, we found a positive relationship between air pollution appraisals and abusive supervision ( $b = .08$ ,  $PSD = .02$ , CI [.05, .11]). In support of H3 and H4, we found a positive relationship between air pollution appraisals and leader somatic complaints ( $b = .09$ ,  $PSD = .03$ , CI [.04, .14]) and leader negative affect, respectively ( $b = .13$ ,  $PSD = .03$ , CI [.07, .19]).

We found that the indirect effect of air pollution appraisals on to the laissez-faire leadership via leader somatic complaints did not exclude zero (indirect effect = .005, 95% CI [-.0001, .0136]), thus H5a was not supported. However, the indirect effect of air pollution appraisals on to abusive supervision via leader somatic complaints excluded zero (indirect effect = .005, 95% CI [.0004, .0113]), thus H5b was supported. The indirect effect of air pollution

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<sup>4</sup> Our model results were similar both with and without control variables. Therefore, we present results from the model without control variables. A table with control variables is presented in the Appendix.

appraisals on to laissez-faire leadership via leader negative affect also excluded zero (indirect effect = .01, 95% CI [.0022, .0212]), thus H6a was supported. Lastly, the indirect effect of air pollution appraisals on to abusive supervision via leader negative affect excluded zero (indirect effect = .011, 95% CI [.0044, .0195]), thus H6b was supported.

[Insert Tables 1 & 2 about here]

## Discussion

The objective of this study was to explore how air pollution appraisals by leaders are associated with physical and emotional strain that can influence their behavior towards their followers. Using a daily diary study conducted on a sample of leaders and their followers working remotely in India, we found that leaders' air pollution appraisals were associated with somatic complaints and negative affect. We found evidence that negative affect mediates the association between air pollution appraisal and leader behaviors of abusive supervision and laissez-faire leadership. We also found evidence that somatic complaints only mediate the positive relationship between appraisals and abusive supervision. Below, we discuss theoretical and practical contributions as well as limitations that pave the way for future research.

## Theoretical Contributions and Practical Implications

Our paper makes several theoretical contributions. First, we expand the literature on destructive leadership by demonstrating how air pollution appraised by leaders can cross over to followers in the form of destructive leadership behaviors. Destructive leadership represents a spectrum of negative leader behaviors including abusive supervision and laissez-faire leadership (Einarsen et al., 2007). Existing research on destructive leadership has focused primarily on work-related antecedents such as leader-follower relationships, workload, and stress (Mackey et al., 2017; Mawritz et al., 2012; Tepper et al., 2011). However, this literature has overlooked the possibility that the physical environment of leaders (such as air pollution) can also influence leaders' negative behaviors toward followers. By integrating crossover theory with the transactional theory of stress, we broaden this literature by demonstrating that appraised air

pollution by leaders can crossover to followers' experience of destructive leadership in the form of abusive supervision and laissez-faire leadership, and that this occurs through the dual mediating mechanism of somatic complaints and negative affect. As the world deals with the effects of global warming and climate change (Huang et al., 2017), leaders around the world are likely going to be exposed to higher air pollution for a larger number of days. By taking a crossover approach to the effects of air pollution (and other forms of physical environmental changes), both leadership theory and practice can be broadened to incorporate the physical environment where leaders are based as a proximal antecedent of their behaviors towards their subordinates. Moreover, by integrating the transactional theory of stress with crossover theory, this study offer insights into the specific mechanisms of somatic complaints and negative affect that link air pollution and leader behavior.

Second, our study demonstrates that leaders' appraisal of air pollution can crossover and influence follower outcomes even through remote work arrangements. In our study leaders were based in a different city than their followers and interacted with them using remote work platforms such as Zoom. Existing research has focused primarily on impact of air pollution on face-to-face interactions with employees (Fehr et al., 2017; Lu et al., 2018). Thus, we might expect appraised air pollution to primarily influence leader outcomes during face-to-face interactions only due to a richer communication medium including body gestures and physical proximity (Cheshin et al., 2011). However, our findings show that despite communicating via remote work platforms only, the subordinates in our sample were able to experience and attribute abuse and inaction to their leaders. This has important implications for the theory and practice of virtual work (Raghuram et al., 2019) as remote work becomes more prevalent and organizations allow existing and new employees to work from different locations. Thus, scholars and practitioners should consider how remote-work employees are influenced by environmental factors tied to their geographical location and how this can influence their work outcomes.

Third, our work contributes to the literature on air pollution and work more broadly. This literature has shown that employees are affected by the air pollution to which they are directly exposed. For instance, work by Fehr et al. (2017) showed that employees experience self-control resource depletion when they appraise air pollution in their place of work. One implication of this current understanding is that employees should not be affected by air pollution experienced by their leaders who are in a different geographic area. By bringing in a crossover perspective to the study of air pollution and integrating it with the transactional theory of stress, this study broadens the air pollution and work literature by showing that employees can be vulnerable to and be impacted by air pollution in a broader geographic area than in which they are themselves located. This finding is important because it suggests that the harmful effects of air pollution on work outcomes might be much more pronounced than previously conceptualized. Employees might be impacted by air pollution that does not exist in their location through an increase in their leader's destructive leadership behaviors towards them.

Our study also has important practical implications. Organizations should invest in creating new and amending existing HR policies to allow employees to be able to avoid air pollution. Examples could include working from home during days of high air pollution, having greater flexibility in work timings and location to avoid travelling during peak pollution times, and making it easier for employees to take days off from work as air pollution sickness days by creating paid leave policies. Organizations should also equip employees to better respond in days with high air pollution through training and resources such as giving them masks and air purifiers and creating air pollution alerts which are sent to employees to avoid or mitigate exposure to air pollution. Organizations can also provide leaders with similar resources that enable them to be more aware of their own well-being and their relationship with followers, as a means to mitigate the effects of somatic symptoms and negative affect on abusive and laissez-faire leadership.

## **Limitations and Future Directions**

This paper has several limitations. First, although this paper focused on air pollution appraisals and leadership outcomes, we did not directly test air pollution appraisals at the primary and secondary stages of appraisal as outlined by the transactional theory of stress. We encourage future researchers to directly test both primarily and secondary appraisals. Testing primary appraisal might entail measuring the extent to which leaders feel harmed or threatened by air pollution. The secondary appraisal process might entail measuring whether leaders have access to resources such as indoor air filtration or high-quality masks (such as N95 masks) that can make them less susceptible to the harmful effects of exposure to toxic air. Second, although our research extends theory on the relationship between air pollution appraisals and leadership outcomes in general, we tested our theory in an indoor setting. Future research should study how leaders who work in outdoor settings are impacted by air pollution appraisals where effects may be even more pronounced (Leung, 2015). Third, we collected data using one survey per day for each of the ten days of our study. This can bias the coefficient estimates and standard errors due to the cross-sectional mediation bias (Maxwell & Cole, 2007). We encourage future research to collect data at multiple time-points during each day to rule out this possibility. Fourth, although we controlled for daily workload and daily commute to work, future research should consider a broader set of control variables in order to rule out third variable explanations.

Fifth, in this paper we did not find a relationship between somatic complaints and laissez-faire leadership. It is possible that this could be because our study was underpowered at Level 2 (58 leaders). This might also suggest that leaders who experience physiological symptoms of air pollution might still have the energy and engagement to direct their followers but in a way that is abusive. From the point of view of the transactional theory of stress, this finding suggests that somatic health might not be a robust antecedent of avoidant behaviors. Thus, when leaders appraise air pollution, their avoidant behaviors may be influenced through an increase in negative affect but not somatic complaints. Future researchers who build their work on the

transactional theory of stress might consider morale as a more robust pathway to social dysfunctioning than somatic complaints, especially in remote work settings. In addition, we found that negative affect and somatic complaints have a stronger relationship with abusive supervision than laissez-faire leadership. Future research should explore when and under what conditions affect and somatic complaints have a stronger relationship with leader behaviors.

Our study also paves the way for important future work. First, our work opens up possibilities for future research to explore how frequency and intensity of reminders of air pollution (through radio, TV news reports, social media accounts, etc.), as well as expectations about the organizations' and the government's responsibility in mitigating air pollution risks impact leaders' rumination and work outcomes. Second, by highlighting two distinct pathways of somatic complaints and negative affect, our work provides a broad base for future researchers to study how climate change related phenomena might influence leader behaviors. While the effect of air pollution (or heat waves) on abusive supervision might be explained by an increase in negative affect, other leadership behaviors might be affected by different mechanisms. For example, charismatic leadership might be influenced more through a decrease in positive affect as a result of air pollution or heat appraisals (Bono & Ilies, 2006; Erez et al., 2008). Moreover, while some leadership behaviors (such as authoritarian) might be similarly impacted through virtual communication media, other leader behaviors (such as charismatic) might only be impacted through face-to-face interactions (Cheshin et al., 2011).

### **Conclusion**

Our study demonstrates that leader appraisals of air pollution are associated with somatic complaints and negative affect. This physical and emotional strain is subsequently associated with leaders behaving more abusively and shirking their responsibilities toward subordinates. Our findings suggest a crossover perspective on pollution which considerably broadens our understanding of how pollution influences leaders and their subordinates.

## References

Almadi, T., Cathers, I., & Chow, C. M. (2013). Associations among work-related stress, cortisol, inflammation, and metabolic syndrome. *Psychophysiology*, 50(9), 821–830. <https://doi.org/10.1111/psyp.12069>

Apkarian, A. V., Sosa, Y., Krauss, B. R., Thomas, P. S., Fredrickson, B. E., Levy, R. E., Harden, R. N., & Chialvo, D. R. (2004). Chronic pain patients are impaired on an emotional decision-making task. *Pain*, 108(1–2), 129–136.

Barnes, C. M., Lucianetti, L., Bhave, D. P., & Christian, M. S. (2015). “You wouldn’t like me when I’m sleepy”: Leaders’ sleep, daily abusive supervision, and work unit engagement. *Academy of Management Journal*, 58(5), 1419–1437. <https://doi.org/10.5465/amj.2013.1063>

Bass, B. M. (1985). *Leadership and performance beyond expectations*. Collier Macmillan.

Bass, B. M., & Avolio, B. J. (1996). Multifactor leadership questionnaire. *Western Journal of Nursing Research*.

Bliese, P. D. (1998). Group size, ICC values, and group-level correlations: A simulation. *Organizational Research Methods*, 1(4), 355–373.

Bono, J. E., & Ilies, R. (2006). Charisma, positive emotions and mood contagion. *The Leadership Quarterly*, 17(4), 317–334. <https://doi.org/10.1016/j.leaqua.2006.04.008>

Braithwaite, I., Zhang, S., Kirkbride, J. B., Osborn, D. P., & Hayes, J. F. (2019). Air pollution (particulate matter) exposure and associations with depression, anxiety, bipolar, psychosis and suicide risk: A systematic review and meta-analysis. *Environmental Health Perspectives*, 127(12), 126002.

Butt, E. W., Turnock, S. T., Rigby, R., Reddington, C. L., Yoshioka, M., Johnson, J. S., Regayre, L. A., Pringle, K. J., Mann, G. W., & Spracklen, D. V. (2017). Global and regional trends in particulate air pollution and attributable health burden over the past 50 years. *Environmental Research Letters*, 12(10), 104017. <https://doi.org/10.1088/1748-9326/aa87be>

Chang, T., Graff Zivin, J., Gross, T., & Neidell, M. (2016). Particulate pollution and the productivity of pear packers. *American Economic Journal: Economic Policy*, 8(3), 141–169.  
<https://doi.org/10.1257/pol.20150085>

Cheshin, A., Rafaeli, A., & Bos, N. (2011). Anger and happiness in virtual teams: Emotional influences of text and behavior on others' affect in the absence of non-verbal cues. *Organizational Behavior and Human Decision Processes*, 116(1), 2–16. <https://doi.org/10.1016/j.obhdp.2011.06.002>

Cho, S., & Kim, S. (2022). Does a healthy lifestyle matter? A daily diary study of unhealthy eating at home and behavioral outcomes at work. *Journal of Applied Psychology*, 107(1), 23–39.  
<https://doi.org/10.1037/apl0000890>

Christian, M. S., Eisenkraft, N., & Kapadia, C. (2015). Dynamic associations among somatic complaints, human energy, and discretionary behaviors: Experiences with pain fluctuations at work. *Administrative Science Quarterly*, 60(1), 66–102. <https://doi.org/10.1177/0001839214553655>

Compas, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological Bulletin*, 127(1), 87.

Connor-Smith, J. K., & Flachsbart, C. (2007). Relations between personality and coping: A meta-analysis. *Journal of Personality and Social Psychology*, 93(6), 1080.

Crawford, E. R., LePine, J. A., & Rich, B. L. (2010). Linking Job Demands and Resources to Employee Engagement and Burnout: A Theoretical Extension and Meta-Analytic Test. *Journal of Applied Psychology*, 95(5), 834–848. <https://doi.org/10.1037/a0019364>

DeCelles, K. A., DeVoe, S. E., Rafaeli, A., & Agasi, S. (2019). Helping to reduce fights before flights: How environmental stressors in organizations shape customer emotions and customer–employee interactions. *Personnel Psychology*, 72(1), 49–80. <https://doi.org/10.1111/peps.12292>

DeLongis, A., Folkman, S., & Lazarus, R. S. (1988). The impact of daily stress on health and mood: Psychological and social resources as mediators. *Journal of Personality and Social Psychology*, 54(3), 486.

Eccleston, C., & Crombez, G. (1999). Pain demands attention: A cognitive-affective model of the interruptive function of pain. *Psychological Bulletin, 125*(3), 356.

Einarsen, S., Aasland, M. S., & Skogstad, A. (2007). Destructive leadership behaviour: A definition and conceptual model. *The Leadership Quarterly, 18*(3), 207–216.

<https://doi.org/10.1016/j.lequa.2007.03.002>

Erez, A., Misangyi, V. F., Johnson, D. E., LePine, M. A., & Halverson, K. C. (2008). Stirring the hearts of followers: Charismatic leadership as the transferal of affect. *Journal of Applied Psychology, 93*(3), 602. <https://doi.org/10.1037/0021-9010.93.3.602>

Fehr, R., Yam, K. C., He, W., Chiang, J. T.-J., & Wei, W. (2017). Polluted work: A self-control perspective on air pollution appraisals, organizational citizenship, and counterproductive work behavior. *Organizational Behavior and Human Decision Processes, 143*, 98–110.

Frijda, N. H. (1994). Varieties of affect: Emotions and episodes, moods, and sentiments. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions* (pp. 59–67). Oxford University Press.

Gallup Inc. (2021, October 13). *Remote Work Persisting and Trending Permanent*. Gallup.Com.

<https://news.gallup.com/poll/355907/remote-work-persisting-trending-permanent.aspx>

Gardiner, H. (2015, February 15). Delhi Wakes Up to Problem It Cannot Ignore: [Foreign Desk]. *New York Times, Late Edition (East Coast)*, A.6.

Geen, R. G., & Quanty, M. B. (1977). The catharsis of aggression: An evaluation of a hypothesis. In *Advances in experimental social psychology* (Vol. 10, pp. 1–37). Elsevier.

Geha, P. Y., Baliki, M. N., Chialvo, D. R., Harden, R. N., Paice, J. A., & Apkarian, A. V. (2007). Brain activity for spontaneous pain of postherpetic neuralgia and its modulation by lidocaine patch therapy. *Pain, 128*(1–2), 88–100.

Gianaros, P. J., & Wager, T. D. (2015). Brain-body pathways linking psychological stress and physical health. *Current Directions in Psychological Science, 24*(4), 313–321.

<https://doi.org/10.1177/0963721415581476>

Gong, S., Lu, J. G., Schaubroeck, J. M., Li, Q., Zhou, Q., & Qian, X. (2020). Polluted psyche: Is the effect of air pollution on unethical behavior more physiological or psychological? *Psychological Science*, 31(8), 1040–1047. <https://doi.org/10.1177/0956797620943835>

Greenberg, J. (2006). Losing sleep over organizational injustice: Attenuating insomniac reactions to underpayment inequity with supervisory training in interactional justice. *Journal of Applied Psychology*, 91(1), 58.

Gucht, V. D., Fischler, B., & Heiser, W. (2003). Job stress, personality, and psychological distress as determinants of somatization and functional somatic syndromes in a population of nurses. *Stress and Health*, 19(4), 195–204. <https://doi.org/10.1002/smi.975>

Guttikunda, S. K., Nishadh, K. A., & Jawahar, P. (2019). Air pollution knowledge assessments (APnA) for 20 Indian cities. *Urban Climate*, 27, 124–141.

Hamilton, N. A., Karoly, P., & Kitzman, H. (2004). Self-regulation and chronic pain: The role of emotion. *Cognitive Therapy and Research*, 28(5), 559–576.

Hansen, A. C., & Selte, H. K. (2000). Air pollution and sick-leaves. *Environmental and Resource Economics*, 16(1), 31–50. <https://doi.org/10.1023/A:1008318004154>

Hinkin, T. R., & Schriesheim, C. A. (2008). An examination of “nonleadership”: From laissez-faire leadership to leader reward omission and punishment omission. *Journal of Applied Psychology*, 93(6), 1234–1248. <https://doi.org/10.1037/a0012875>

Hoobler, J. M., & Hu, J. (2013). A model of injustice, abusive supervision, and negative affect. *The Leadership Quarterly*, 24(1), 256–269. <https://doi.org/10.1016/j.lequa.2012.11.005>

Howell, J. M., & Shamir, B. (2005). The role of followers in the charismatic leadership process: Relationships and their consequences. *Academy of Management Review*, 30(1), 96–112.

Huang, J., Zhang, X., Zhang, Q., Lin, Y., Hao, M., Luo, Y., Zhao, Z., Yao, Y., Chen, X., & Wang, L. (2017). Recently amplified arctic warming has contributed to a continual global warming trend. *Nature Climate Change*, 7(12), 875–879. <https://doi.org/10.1038/s41558-017-0009-5>

Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental Pollution*, 151(2), 362–367.

Kaplan, S., Bradley, J. C., Luchman, J. N., & Haynes, D. (2009). On the role of positive and negative affectivity in job performance: A meta-analytic investigation. *Journal of Applied Psychology*, 94(1), 162–176. <https://doi.org/10.1037/a0013115>

Kawano, Y. (2008). Association of job-related stress factors with psychological and somatic symptoms among Japanese hospital nurses: Effect of departmental environment in acute care hospitals. *Journal of Occupational Health*, 50(1), 79–85.

Koopman, J., Conway, J. M., Dimotakis, N., Tepper, B. J., Lee, Y. E., Rogelberg, S. G., & Lount, R. B. Jr. (2020). Does CWB repair negative affective states, or generate them? Examining the moderating role of trait empathy. *Journal of Applied Psychology*. <https://doi.org/10.1037/apl0000837>

Korszun, A., Young, E. A., Engleberg, N. C., Masterson, L., Dawson, E. C., Spindler, K., McClure, L. A., Brown, M. B., & Crofford, L. J. (2000). Follicular phase hypothalamic-pituitary-gonadal axis function in women with fibromyalgia and chronic fatigue syndrome. *The Journal of Rheumatology*, 27(6), 1526–1530.

Korszun, A., Young, E. A., Singer, K., Carlson, N. E., Brown, M. B., & Crofford, L. (2002). Basal circadian cortisol secretion in women with temporomandibular disorders. *Journal of Dental Research*, 81(4), 279–283.

Kruschke, J. K., Aguinis, H., & Joo, H. (2012). The time has come: Bayesian methods for data analysis in the organizational sciences. *Organizational Research Methods*, 15(4), 722–752.

Kumar, H., & Schmall, E. (2021, November 18). New Delhi's Air Turns Toxic, and the Finger-Pointing Begins. *The New York Times*. <https://www.nytimes.com/2021/11/18/world/asia/india-new-delhi-pollution.html>

Kuo, C.-Y., Wong, R.-H., Lin, J.-Y., Lai, J.-C., & Lee, H. (2006). Accumulation of chromium and nickel metals in lung tumors from lung cancer patients in Taiwan. *Journal of Toxicology and Environmental Health, Part A*, 69(14), 1337–1344.

Lazarus, R., & Folkman, S. (1984). *Stress, Appraisal, and Coping*. Springer.

Lazarus, R. S. (1991). *Emotion and adaptation*. Oxford University Press.

Leger, K. A., Charles, S. T., & Almeida, D. M. (2018). Let it go: Lingering negative affect in response to daily stressors is associated with physical health years later. *Psychological Science*, 29(8), 1283–1290. <https://doi.org/10.1177/0956797618763097>

Lepine, J. A., Podsakoff, N. P., & Lepine, M. A. (2005). A Meta-Analytic Test of the Challenge Stressor–Hindrance Stressor Framework: An Explanation for Inconsistent Relationships Among Stressors and Performance. *Academy of Management Journal*, 48(5), 764–775.  
<https://doi.org/10.5465/amj.2005.18803921>

Leung, D. Y. C. (2015). Outdoor-indoor air pollution in urban environment: Challenges and opportunity. *Frontiers in Environmental Science*, 2. <https://doi.org/10.3389/fenvs.2014.00069>

Lim, S., & Tai, K. (2014). Family incivility and job performance: A moderated mediation model of psychological distress and core self-evaluation. *Journal of Applied Psychology*, 99(2), 351–359.  
<https://doi.org/10.1037/a0034486>

Lu, J. G., Lee, J. J., Gino, F., & Galinsky, A. D. (2018). Polluted morality: Air pollution predicts criminal activity and unethical behavior. *Psychological Science*, 29(3), 340–355.  
<https://doi.org/10.1177/0956797617735807>

Mackey, J. D., Frieder, R. E., Brees, J. R., & Martinko, M. J. (2017). Abusive Supervision: A Meta-Analysis and Empirical Review. *Journal of Management*, 43(6), 1940–1965.  
<https://doi.org/10.1177/0149206315573997>

Mawritz, M. B., Mayer, D. M., Hoobler, J. M., Wayne, S. J., & Marinova, S. V. (2012). A Trickle-down Model of Abusive Supervision. *Personnel Psychology*, 65(2), 325–357.  
<https://doi.org/10.1111/j.1744-6570.2012.01246.x>

Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods, 12*(1), 23–44. <https://doi.org/10.1037/1082-989X.12.1.23>

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *The New England Journal of Medicine, 338*(3), 171–179. <https://doi.org/10.1056/NEJM199801153380307>

Meier, L. L., Gross, S., Spector, P. E., & Semmer, N. K. (2013). Relationship and task conflict at work: Interactive short-term effects on angry mood and somatic complaints. *Journal of Occupational Health Psychology, 18*(2), 144.

Muthén, B. (2010). *Bayesian analysis in Mplus: A brief introduction*. Citeseer.

Muthén, L. K., & Muthén, B. (2017). *Mplus user's guide: Statistical analysis with latent variables, user's guide*. Muthén & Muthén.

Nawrot, T., Plusquin, M., Hogervorst, J., Roels, H. A., Celis, H., Thijs, L., Vangronsveld, J., Van Hecke, E., & Staessen, J. A. (2006). Environmental exposure to cadmium and risk of cancer: A prospective population-based study. *The Lancet Oncology, 7*(2), 119–126.

Nevin, R. (2000). How lead exposure relates to temporal changes in IQ, violent crime, and unwed pregnancy. *Environmental Research, 83*(1), 1–22. <https://doi.org/10.1006/enrs.1999.4045>

Ng, T. W. H., & Yam, K. C. (2019). When and why does employee creativity fuel deviance? Key psychological mechanisms. *Journal of Applied Psychology, 104*(9), 1144–1163.  
<https://doi.org/10.1037/apl0000397>

Niedhammer, I., David, S., Degioanni, S., Drummond, A., Philip, P., & Physicians, 143 Occupational. (2009). Workplace bullying and sleep disturbances: Findings from a large scale cross-sectional survey in the French working population. *Sleep, 32*(9), 1211–1219.

Nuyts, V., Nawrot, T. S., Scheers, H., Nemery, B., & Casas, L. (2019). Air pollution and self-perceived stress and mood: A one-year panel study of healthy elderly persons. *Environmental Research, 177*, 108644. <https://doi.org/10.1016/j.envres.2019.108644>

Orru, H., Ebi, K. L., & Forsberg, B. (2017). The Interplay of Climate Change and Air Pollution on Health. *Current Environmental Health Reports*, 4(4), 504–513. <https://doi.org/10.1007/s40572-017-0168-6>

Ostro, B. D. (1983). The effects of air pollution on work loss and morbidity. *Journal of Environmental Economics and Management*, 10(4), 371–382. [https://doi.org/10.1016/0095-0696\(83\)90006-2](https://doi.org/10.1016/0095-0696(83)90006-2)

Owens, B. P., & Hekman, D. R. (2016). How does leader humility influence team performance? Exploring the mechanisms of contagion and collective promotion focus. *Academy of Management Journal*, 59(3), 1088–1111. <https://doi.org/10.5465/amj.2013.0660>

Pandey, A., Brauer, M., Cropper, M. L., Balakrishnan, K., Mathur, P., Dey, S., Turkogulu, B., Kumar, G. A., Khare, M., & Beig, G. (2021). Health and economic impact of air pollution in the states of India: The Global Burden of Disease Study 2019. *The Lancet Planetary Health*, 5(1), e25–e38.

Pennebaker, J. W. (2012). *The psychology of physical symptoms*. Springer Science & Business Media.

Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods*, 15(3), 209–233.

Raghuram, S., Hill, N. S., Gibbs, J. L., & Maruping, L. M. (2019). Virtual Work: Bridging Research Clusters. *Academy of Management Annals*, 13(1), 308–341. <https://doi.org/10.5465/annals.2017.0020>

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, 110(1), 145.

Shaddick, G., Thomas, M. L., Mudu, P., Ruggeri, G., & Gumy, S. (2020). Half the world's population are exposed to increasing air pollution. *Npj Climate and Atmospheric Science*, 3(1), 1–5. <https://doi.org/10.1038/s41612-020-0124-2>

Shaver, P., Schwartz, J., Kirson, D., & O'connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology*, 52(6), 1061.

Simon, L. S., Hurst, C., Kelley, K., & Judge, T. A. (2015). Understanding cycles of abuse: A multimotive approach. *Journal of Applied Psychology*, 100(6), 1798–1810.  
<https://doi.org/10.1037/apl0000031>

Skogstad, A., Einarsen, S., Torsheim, T., Aasland, M., & Hetland, H. (2007). The destructiveness of laissez-faire leadership behavior. *Journal of Occupational Health Psychology*, 12, 80–92.  
<https://doi.org/10.1037/1076-8998.12.1.80>

Spector, P. E. (1987). Interactive effects of perceived control and job stressors on affective reactions and health outcomes for clerical workers. *Work & Stress*, 1(2), 155–162.

Staud, R., & Domingo, M. (2001). Evidence for abnormal pain processing in fibromyalgia syndrome. *Pain Medicine*, 2(3), 208–215.

Tager, I. B., Balmes, J., Lurmann, F., Ngo, L., Alcorn, S., & Künzli, N. (2005). Chronic exposure to ambient ozone and lung function in young adults. *Epidemiology*, 751–759.

Tepper, B. J. (2000). Consequences of abusive supervision. *Academy of Management Journal*, 43(2), 178–190.

Tepper, B. J., Moss, S. E., & Duffy, M. K. (2011). Predictors of Abusive Supervision: Supervisor Perceptions of Deep-Level Dissimilarity, Relationship Conflict, and Subordinate Performance. *Academy of Management Journal*, 54(2), 279–294. <https://doi.org/10.5465/amj.2011.60263085>

Turk, D. C., & Rudy, T. E. (1986). Assessment of cognitive factors in chronic pain: A worthwhile enterprise? *Journal of Consulting and Clinical Psychology*, 54(6), 760.

US EPA. (2016). *Health and Environmental Effects of Particulate Matter (PM)* [Overviews and Factsheets]. <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

Wagner, D. T., Barnes, C. M., & Scott, B. A. (2014). Driving it home: How workplace emotional labor harms employee home life. *Personnel Psychology*, 67(2), 487–516.  
<https://doi.org/10.1111/peps.12044>

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063.

Westman, M. (2001). Stress and strain crossover. *Human Relations*, 54(6), 717–751.  
<https://doi.org/10.1177/0018726701546002>

WHO. (2018a). *Ambient (outdoor) air pollution*. [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

WHO. (2018b). *WHO global ambient air quality database (update 2018)*. World Health Organization.

Wu, J., Watkins, D., Williams, J., Bhagat, S. V., Kumar, H., Gentleman, J., Taylor, R., Davis, L., & Singh, K. D. (2020, December 17). Who Gets to Breathe Clean Air in New Delhi? *The New York Times*.  
<https://www.nytimes.com/interactive/2020/12/17/world/asia/india-pollution-inequality.html>

Yuan, Y., & MacKinnon, D. P. (2009). Bayesian mediation analysis. *Psychological Methods*, 14(4), 301.

Zhang, J., Liu, Y., Cui, L., Liu, S., Yin, X., & Li, H. (2017). Ambient air pollution, smog episodes and mortality in Jinan, China. *Scientific Reports*, 7(1), 11209. <https://doi.org/10.1038/s41598-017-11338-2>

Zijlema, W. L., Wolf, K., Emeny, R., Ladwig, K. H., Peters, A., Kongsgård, H., Hveem, K., Kvaløy, K., Yli-Tuomi, T., Partonen, T., Lanki, T., Eeftens, M., de Hoogh, K., Brunekreef, B., Stolk, R. P., & Rosmalen, J. G. M. (2016). The association of air pollution and depressed mood in 70,928 individuals from four European cohorts. *International Journal of Hygiene and Environmental Health*, 219(2), 212–219. <https://doi.org/10.1016/j.ijheh.2015.11.006>

Zineldin, M., & Hytter, A. (2012). Leaders' negative emotions and leadership styles influencing subordinates' well-being. *The International Journal of Human Resource Management*, 23(4), 748–758. <https://doi.org/10.1080/09585192.2011.606114>

Zyphur, M. J., & Oswald, F. L. (2013). Bayesian probability and statistics in management research: A new horizon. *Journal of Management*, 39(1), 5–13. <https://doi.org/10.1177/0149206312463183>



Table 1.  
*Means, SDs, and Intercorrelations Among Study Variables*

| Measure                                | <i>M</i> | <i>(SD)</i> | 1.      | 2.      | 3.       | 4.       | 5.       | 6.       | 7.       | 8.       | 9.       | 10.   | 11.    |
|----------------------------------------|----------|-------------|---------|---------|----------|----------|----------|----------|----------|----------|----------|-------|--------|
| 1. Abusive Supervision                 | 1.64     | (0.54)      | —       | .49 *** | -.38 *** | .69 ***  | -.38 *** | .02      | -.08     | -.53 *** | -.68 *** | -.12  | .07    |
| 2. Laissez-Faire Leadership            | 1.98     | (0.58)      | .40 *** | —       | -.65 *** | .64 ***  | -.71 *** | -.52 *** | -.55 *** | -.51 *** | -.58 *** | .36 * | -.27   |
| 3. Leader Somatic Complaints           | 2.27     | (0.88)      | .18 *** | .15 **  | —        | -.40 *** | .76 ***  | .26 *    | .57 ***  | .35 ***  | .42 *    | .05   | .26    |
| 4. Leader Negative Affect              | 1.88     | (0.74)      | .24 *** | .19 *** | .27 ***  | —        | -.39 *** | .03      | -.14     | -.27 *** | -.74 *** | .25   | .32 *  |
| 5. Air Pollution Appraisals (Leader)   | 3.99     | (1.13)      | .26 *** | .29 *** | .15 ***  | .17 ***  | —        | .47 ***  | .82 ***  | .73 ***  | .23      | .11   | .31 *  |
| 6. Air Pollution Appraisals (Follower) | 3.31     | (1.15)      | .28 *** | .29 *** | .07      | .10      | .64 ***  | —        | .59 ***  | .46 ***  | -.44 *   | -.11  | .44 ** |
| 7. Objective Air Pollution             | 144.51   | (47.02)     | .24 *** | .26 *** | .05      | .07      | .57 ***  | .46 ***  | —        | .55 ***  | .08      | -.02  | .32 *  |
| 8. Leader Workload                     | 3.26     | (0.85)      | -.08    | -.03    | .01      | .05      | -.13 *   | -.27 *** | —        | .16 ***  | -.09     | .07   | .29 *  |
| 9. Leader Daily Commute (2=Yes, 1=No)  | 1.63     | (0.48)      | -.05    | -.09 *  | .06      | -.08     | -.09     | -.08     | .00      | -.04     | —        | .14   | .36    |
| 10. Leader Gender (1=Female)           | 0.16     | (0.37)      |         |         |          |          |          |          |          |          | —        | .20   |        |
| 11. Leader Tenure                      | 8.80     | (3.71)      |         |         |          |          |          |          |          |          | —        |       |        |

Note. *N* (level 1) = 569; *N* (level 2) = 32-57 (pairwise). Correlations reported below the diagonal are within-individual (Level 1) and correlations about the diagonal are between-level. Between-person correlations involving within-person variables are based on averages across measurement occasions.

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

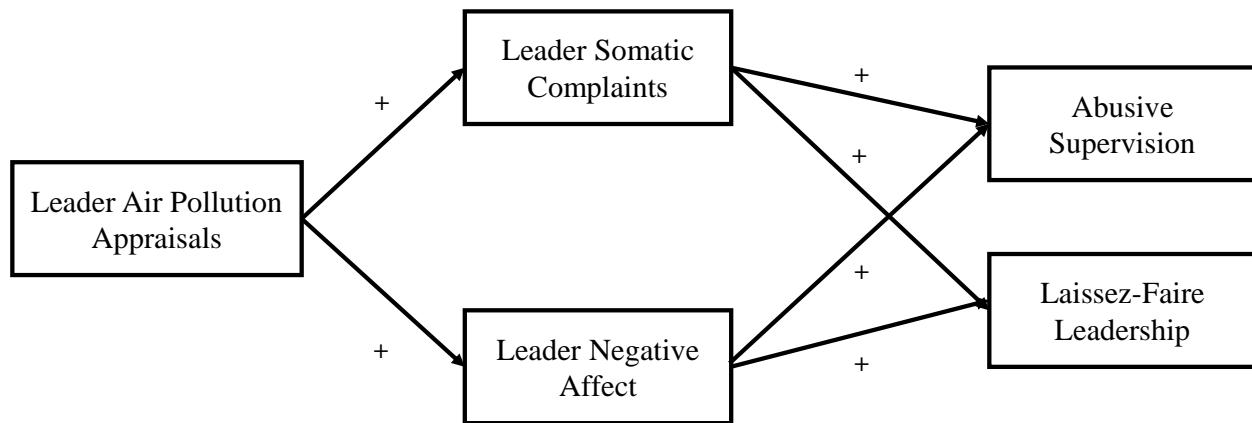
**Table 2: Multilevel Path Model Results (without controls)**

Table 2.

*Multilevel Path Model Results (without controls)*

|                                 | Somatic Complaints |       |              | Negative Affect |       |              | Abusive Supervision |       |              | Lassez Faire Leadership |       |               |
|---------------------------------|--------------------|-------|--------------|-----------------|-------|--------------|---------------------|-------|--------------|-------------------------|-------|---------------|
|                                 | B                  | PSD   | 95% CI       | B               | PSD   | 95% CI       | B                   | PSD   | 95% CI       | B                       | PSD   | 95% CI        |
| Leader Air Pollution Appraisals | 0.090              | 0.028 | 0.035, 0.144 | 0.128           | 0.032 | 0.067, 0.191 | 0.076               | 0.015 | 0.046, 0.106 | 0.135                   | 0.022 | 0.092, 0.177  |
| Somatic Complaints              |                    |       |              |                 |       |              | 0.054               | 0.025 | 0.006, 0.103 | 0.058                   | 0.035 | -0.011, 0.127 |
| Negative Affect                 |                    |       |              |                 |       |              | 0.086               | 0.022 | 0.043, 0.129 | 0.081                   | 0.031 | 0.021, 0.141  |

Notes:  $N$  (level 1) = 569;  $N$  (level 2) = 58. Unstandardized coefficients are reported. PSD= standard deviation of the posterior distribution (Bayesian Estimation method). CI = 95% Credibility Intervals

**Figure 1: Proposed Theoretical Model**

## Appendix

### Model With Control Variables

Table 3.  
*Multilevel Path Model Results (with controls)*

|                                      | Somatic Complaints |       |               | Negative Affect |       |               | Abusive Supervision |       |               | Lassez Faire Leadership |       |               |
|--------------------------------------|--------------------|-------|---------------|-----------------|-------|---------------|---------------------|-------|---------------|-------------------------|-------|---------------|
|                                      | B                  | PSD   | 95% CI        | B               | PSD   | 95% CI        | B                   | PSD   | 95% CI        | B                       | PSD   | 95% CI        |
| Air Pollution Appraisals             | 0.126              | 0.033 | 0.060, 0.192  | 0.142           | 0.038 | 0.067, 0.217  | 0.011               | 0.022 | -0.031, 0.054 | 0.045                   | 0.031 | -0.015, 0.105 |
| Somatic Complaints                   |                    |       |               |                 |       |               | 0.057               | 0.024 | 0.010, 0.105  | 0.064                   | 0.035 | -0.004, 0.131 |
| Negative Affect                      |                    |       |               |                 |       |               | 0.089               | 0.021 | 0.047, 0.131  | 0.087                   | 0.030 | 0.028, 0.147  |
| Air Pollution Appraisals (Followers) |                    |       |               |                 |       |               | 0.071               | 0.023 | 0.026, 0.115  | 0.096                   | 0.032 | 0.032, 0.158  |
| Objective Air Pollution              | -0.001             | 0.001 | -0.003, 0.000 | -0.001          | 0.001 | -0.002, 0.001 | 0.001               | 0.000 | 0.000, 0.002  | 0.001                   | 0.001 | 0.000, 0.002  |
| Leader Workload                      | 0.041              | 0.033 | -0.025, 0.106 | 0.059           | 0.038 | -0.015, 0.133 |                     |       |               |                         |       |               |
| Leader Commute                       | -0.154             | 0.087 | -0.325, 0.016 | 0.162           | 0.100 | -0.033, 0.357 |                     |       |               |                         |       |               |
| Day of the Study                     | 0.022              | 0.007 | 0.008, 0.036  | 0.013           | 0.008 | -0.003, 0.029 |                     |       |               |                         |       |               |
| Tuesday                              | 0.058              | 0.074 | -0.086, 0.205 | -0.065          | 0.085 | -0.233, 0.102 |                     |       |               |                         |       |               |
| Wednesday                            | -0.006             | 0.075 | -0.151, 0.140 | -0.023          | 0.086 | -0.190, 0.149 |                     |       |               |                         |       |               |
| Thursday                             | -0.066             | 0.076 | -0.214, 0.082 | -0.127          | 0.089 | -0.301, 0.046 |                     |       |               |                         |       |               |
| Friday                               | -0.134             | 0.078 | -0.289, 0.018 | -0.049          | 0.089 | -0.225, 0.122 |                     |       |               |                         |       |               |

Notes: N (level 1) = 572; N (level 2) = 58. Unstandardized coefficients are reported. PSD = standard deviation of the posterior distribution. CI = Credibility Intervals