

2016

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## Recommended Citation

Holland, Damon M., "Cost of Commuting: A Review of Determinants, Outcomes, and Theories of Commuting-Related Stress" (2016). *University Honors Theses*. Paper 299.  
<https://doi.org/10.15760/honors.263>

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Cost of Commuting:

A Review of Determinants, Outcomes, and Theories of Commuting-related Stress

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Undergraduate Honors Thesis

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## Abstract

Commuter-related stress, its history, associated determinants, outcomes in work environments and theoretical and methodological approaches are examined. In this cross-disciplinary review, I synthesize the research findings on commuting-related stress as it relates to workplace outcomes. In the extant literature, *control*, *predictability*, *impedance*, and *length of commute* are commonly associated with commuter stress. In addition, prior research has identified workplace aggression and absenteeism as prominent work-related outcomes of commuter stress.

*Keywords:* commute, stress, control, predictability, impedance

### Cost of commuting:

A review of determinants, outcomes, and theories of commuting-related stress

Commuting is an accepted and pervasive part of day-to-day life for millions of people nationwide (Navaco, Stokols, and Milanese, 1990). As urban areas continue to spread, the necessity of commuting will likely continue to grow. According to US census data, the average worker spends 25 minutes commuting from home to work (McKenzie & Rapino, 2011), which equates to 26 billion hours of commuting for U.S. workers each year. Getting stuck in gridlock traffic, squeezing into a crowded bus, or pushing onto a cramped train are all common occurrences in the lives of U.S. workers. Not only is commuting a common occurrence, but it is also a necessary daily activity for the average employee. Besides the damaging impact on the environment due to green-house gas emissions (Laurenzi & Jersey, 2013), commuting may be related to numerous social and occupational dangers such as workplace aggression (Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005; Hennessy, 2008) and absenteeism (Knox, 1961; Lorenz and Goerke, 2015; Magee, Stefanic, Caputi & Iverson, 2011; Navaco et al., 1990; Van Ommeren, Gutierrez-i-Puigarnau, 2011). As such, it is important to understand how to mitigate or lessen commuting-related stress (henceforth referred to as *commuting stress*).

For the purposes of this thesis, commuting is defined as the journey between home and work via personal vehicle (e.g., automobile). Commuting and its correlates (e.g., loss of perceived control, length of commute, and predictability or reliability of commute) have been associated with stress. The effects of general stress are well-documented and have been studied extensively (Fraser, Ingram, Anderson, Morrison, Davies, & Connell, 1999; McEwen, 2007). The physical effects of general stress can be detrimental, as stress has been shown to influence cardiovascular functioning, risk of strokes, poor sleep, and an increase in stress hormone levels

(McEwen, 2007) as well as body-mass index and cholesterol levels (Fraser et al., 1999).

Moreover, the effects of stress extend to broader systems such as world economies. According to an executive summary by the International Labour Organization (Gabriel & Liimatainen, 2000), the European Union's financial costs related to mental health problems is estimated at 3-4% of GNP. That is around €265 billion (around \$304 billion) in the European Union alone.

Furthermore, Turner, Wheaton, and Lloyd (1995) found that many of these mental health problems may be directly associated to stress. In addition, Turner et al. (1995) found that the overall distribution of stress exposure across numerous variables corresponds to the distribution of depressive symptoms and depressive disorders.

While commuting may appear to be a relatively minor source of stress, its inescapability and pervasiveness globalize its impact. To that point, Navaco et al., (1990) found that 90% of the U.S. labor force use cars as their primary (and often only) mode of transportation. While not every person is unduly stressed due to their commute, the aforementioned health-related concerns may pose certain risks due to the association between stress and commuting (Navaco, Stokols, Campbell, & Stokols, 1979; Navaco et al., 1990). While stress has been defined in different ways, this review will use Lazarus and Launier's (1978) definition of stress as, "a relational or transactional concept describing certain kinds of adaptive commerce between any system (e.g., a person) and an environment" (p. 293). In accordance with this definition, commuting stress involves the interaction between the individual (system) and commuting (an environmental factor). While commuting may simply appear as a daily annoyance, its association with stress warrants a closer look.

It should be noted that not all stress is negative. Stress or arousal has been shown to increase some potentially positive behaviors. For instance, Yerkes and Dodson (1908)

experimented on mice using electric shocks as a negative stimulus. They found that these arousals (from the electric shocks) increased habit formation and rapidity of learning such that these stressful events/arousals motivated the mice to avoid certain behaviors. More recently, Cavanaugh, Boswell, Roehling, and Boudreau (2000) observed two kinds of stressors within a sample of managers. These stressors are referred to as challenge and hindrance stressors. Challenge stressors are perceived by an individual as opportunities to learn or overcome and are associated with higher job satisfaction, whereas hindrance stressors are perceived by an individual as potentially damaging to personal goals or growth and are associated with lower job satisfaction. On the one hand, commuter stress can be construed as a hindrance. To that point, Evans and Stecker (2004) found that exposure to chronic environmental stressors is related with decreased persistence on tasks. Relatedly, Schaeffer, Street, Singer, and Baum (1988) found that when exposed to traffic congestion (an uncontrollable, environmental stressor) people were less persistent in solving the Stroop color word discrimination test, suggesting that commuting may be a hindrance stressor. On the other hand, commuting has the potential to restrict an individual's available time resources, and time pressure has been identified as a challenge stressor (Cavanaugh et al., 2000). Regardless of the form, however, chronic exposure to hindrance or challenge stressors may be detrimental for individuals' well-being (LePine, Podsakoff, & LePine, 2005; Podsakoff, LePine, & LePine, 2007).

Commuting stress occurs directly before the employee enters work, and it is this proximity that may increase the likelihood of negative spillover into the workplace and/or other negative workplace outcomes. While researchers have found myriad associated outcomes, they do not yet know much about the specific determinants of commuting stress. As such, in my review, I will attempt to outline the general history and evolution of the study of commuting

stress. Further, I will attempt to synthesize research from several fields in social science into a cohesive framework exploring the negative workplace outcomes associated with commuting to work and assess the theoretical and methodological frameworks used in commuting stress research. Additionally, this review will attempt to identify potential problems and gaps within the existing research in order to educate and foster future studies.

### **Method**

For this review, I searched multiple databases. Specifically, I accessed EBSCO Host, Academic Search Premier, Google Scholar, and JSTOR. I searched the following keywords in various combinations: *commuter stress*, *commuting stress*, *commuting problems*, *commuting dangers*, *commuting effect on workplace*, *workplace outcomes of commuter stress*, *commuting aggression*, *commuting burnout*, *commuting and job performance*, *commuting outcomes*, *commuting psychology*, *commuting side-effects*, *commuting and family*, and *commuting family effect*. I selected articles from multiple disciplines, such as psychology, management, sociology, biology, economics, political science, urban planning, and civil engineering. Psychology, management, and sociology papers were primarily used to inform theory, methodology, and statistical analyses related to commuting stress, its determinants, and workplace impacts. Sources from the field of biology were used to explain the physiological effects of stress. I used research from economics, political science, urban planning, and engineering to explain impacts not covered by the other disciplines (e.g., economic cost of commuting, traffic congestion, and demographic information on commuter habits). I emphasized studies with rigorous methodological approaches. For a contemporary perspective, I identified relatively recent research findings (most of which were published in the last 10 years) when discussing the impact of commuting stress on workplace outcomes. This review included research on personal

vehicular commuting only (e.g., by automobile). I chose not to include sources on mass transit (e.g., bus, train) commuting due to a relative lack of research pertaining to these commuting modalities. The original research I included used both cross-sectional and longitudinal designs.

### **Literature Review**

In this literature review, I will cover three objectives. For the first objective, I will provide an historical overview of commuting stress research. I will highlight the most important and noteworthy research from its inception through 2015. This will provide a platform to understand how this research area has evolved, and it will inform the subsequent objectives. For my second objective, I will discuss the factors contributing to commuting stress and the associated workplace outcomes. More specifically, this section will introduce the specific determinants associated with commuting stress and explain how these factors can spill over to the workplace. For the third and final objective, I will explore the most accepted theoretical framework associated with commuting stress – the transactional stress model (Lazarus, 1966) – as well as the various methodological approaches employed by prior research.

### **Historical Background**

The stress process, as it relates to commuting, was not explored in earnest until the 1970s. This could be related to a lack of interest in the topic, a failure to recognize the phenomenon, or due to the fact that our current conceptualization of commuting stress differs from prior conceptualizations. Whatever the impetus, modern research on commuting stress and its consequences was brought forth by Navaco et al. (1979). Navaco and colleagues were the first to apply theoretical knowledge and empirical analysis to the subject of commuting stress, even though there were previous studies on transportation changes and its effects on social and economic issues (e.g., Schaeffer & Schlar, 1980), the process in which community values are



integrated into the transportation planning (e.g., Catalano & Monahan, 1976; Olson, 1969), and even research investigating public opinion on mass transit, and using that information to develop strategies for expanding ridership on mass transit services (Deslauriers & Everett, 1977; Everett et al., 1974; Horowitz & Sheth, 1976). They observed an area of psychology – that is, transportation stress – that had not yet received much research attention. While research to that point had explored the experience of commuting and its significance (Catalano & Monahan, 1976; Deslauriers & Everett, 1977; Everett et al., 1974; Horowitz & Sheth, 1976; Olson, 1969), Navaco and colleagues were the first to study human adaptation in response to stress with respect to psychological theory.

Perhaps the most important piece of information to come from Navaco et al. (1979) was their metric of impedance, where *impedance* is defined as a three-level factor (low, medium, high) based on the joint distribution of distance and time of commute. The basic concept of this being that commuting stress is not simply based on distance or time, but an interplay between the two factors. One could exemplify impedance by concluding that a 20-mile commute that takes 20 minutes is less stressful than a 10-mile commute that takes 20 minutes. Impedance was – and continues to be – a common metric when researching commuting stress. In addition, Navaco and colleagues were the first to use the transactional stress model (Lazarus, 1966) in this context. To date, this particular theory has continued to be favored for studying commuting stress. As such, these researchers contributed much of the framework that contemporary psychologists still use today when studying this phenomenon.

Commuting research began to gain more attention in the late 1980s to early 1990s. Around this time, studies emerged that demonstrated that the commuting experience was a notable contributor to workplace-related stress (Schaeffer, Street, Singer, & Baum, 1988).

Subsequent research, however, was conducted to explore commuting stress in a more refined manner. As a nascent subfield – and thus relatively unexplored – there were problems with construct-definition consistency for focal variables in the realm of commuting stress.

Koslowsky (1997) attempted to identify the aforementioned deficiencies by highlighting these issues and attempting to unify varying construct definitions for prominent variables. To do so, Koslowsky conducted a thorough literature review in order to standardize definitions of variables and observed interaction effects. To that effect, Koslowsky (1997) states the following: “For example, simple use of objective measures of the commuting experience, time or distance, individually or in combination, does not appear to provide adequate explanation or prediction of individual and organizational outcomes” (p. 154). This literature review resulted in a complete list of the variables, determinants, and moderators Koslowsky found to be most common. These included: gender, control, locus of control, sense of motion and control, predictability, time urgency, time management, and morning versus evening commutes. Although current research has not corroborated the validity of all of Koslowsky’s chosen measures, a centralized list of variable definitions has added value to the area of commuting research.

In sum, contemporary research findings have had a major impact on the issue of commuting stress. By elucidating the relationships between commuting stress and various outcomes, scientists can begin to understand the detrimental effects of commuting stress in the workplace and other life domains. Further, by identifying potential moderators that buffer the relation between commuting stress and various outcomes (e.g., social support; Glanz et al., 2008), recommendations can be made for attenuating the negative effects of an often unavoidable source of stress.

### **Antecedents of Commuting Stress and Workplace Outcomes**

As discussed in the previous section, a stress response due to the action of commuting was put forward by Navaco et al. (1979). However, because they were pioneering the field, they simply tested whether or not there was a relationship between commuting and stress.

Koslowsky (1997) integrated and synthesized accumulated research which helped researchers to explore new research directions. It was not until after Koslowsky's study that there were many attempts at studying commuting stress outcomes. Building upon previous knowledge and findings, researchers began exploring how commuting stress could impact other environments (work, home, interpersonal relationships). Additionally, contemporary researchers were able to focus on specific factors that contribute to the stress-related outcomes of commuting.

The specific determinants of commuting stress are very important. It is important to understand the components and antecedents of a phenomenon prior to intervening in or manipulating that phenomenon. Earlier research suggested numerous reasons of why commuting is stressful (Koslowsky, 1997; Navaco et al., 1979), but the most salient and generally accepted studies on commuter-related stress determinants have been relatively contemporary. Nevertheless, while there is growing consensus on the prominent determinants, there is great debate regarding which one is most strongly associated with commuting stress. Numerous researchers have conducted studies that claim that *control* is the most powerful antecedent of commuting stress (Koslowsky et al., 1996; Nivens & Norstrom, 2012; Sposato et al., 2012). The accepted concept being that when a commuting individual no longer has direct control of his/her commuting progress, he/she begins to experience stress. This lack of control can come from numerous external forces such as traffic congestions, road closures and car troubles, but when control is lost, stress has been shown to occur. Other researchers view *length of commute* or *commute time* as the most strongly associated factor to commuting stress (Cantwell et al., 2009),

such that the overall time spent commuting is positively correlated with the level of stress experienced. Other researchers contend that the *predictability* or *reliability* of the commute is central to the commuting stress experience (Evans et al., 2002; Wener, Evans & Boatley, 2005). While there are other determinants associated with commuting stress, control, commute length/commute time, and predictability/reliability appear to be the most central to the commuting stress experience.

Commuting stress seems to be pertinent in the context of commuters' workplace experiences and behaviors. That is, commuters' experiences of commuting stress may spill over to the workplace. Hennessy (2008) defines spillover effects as "unresolved difficulties from one domain that accumulate and unconsciously influence the interpretation of, and intensify negative reaction to, stressors in subsequent domains" (p. 2326). In the work environment, these spillover effects can manifest in numerous ways. Although the commuting stress and spillover effect is not a causal relationship, this specific stressor does increase the likelihood of spillover in work (Hennessy, 2008; Wener et al., 2005). I will be discussing several, well-documented spillover effects in the workplace.

*Aggression* has been shown to be a potential behavioral manifestation of commuting stress spilling over to the workplace – but mainly for men. Hennessy (2008) notes: "As expected, state driver stress was related to subsequent acts of workplace aggression, but only for males and only in the form of expressed hostility and obstructionism" (p. 2325). Expressed hostility is defined as verbal outbursts, angry or discontented feelings, and negative attitudes towards fellow workers. Obstructionism involves actions meant to impede another's performance or hamper progress (Hennessy, 2008). Hennessy (2008) outlines how commuting stress can lead to workplace aggression in males. Men showed an increase in aggressive tendencies across two of

the three aggression measures Hennessy used – specifically only for expressed hostility and obstructionism. To that end, the likelihood to categorize workplace stress as a major hassle to daily life was more prevalent in men (Almeida, Wethington, & Kessler, 2003). Furthermore, Campbell, Muncer, and Gorman (1993) found that men are more accepting of aggressive tendencies as suitable coping behavior. While their study was not specifically in the context of work, their findings could explain why men display more aggressive tendencies, in response to commuting stress at work (Hennessy, 2008). Regardless of the specific reason for this gender difference, the research has shown that commuting stress is associated with increased workplace aggression in men.

Another potentially damaging organizational effect of commuting stress spillover is *job absenteeism*. Researchers have found evidence of an increase in job absenteeism due to length of commute (Knox, 1961) and an increase of absent days due to sickness. Navaco, Stokol, and Milanesi (1990) theorized that these sick days were related to the physiological effects of stress leading to an increase in sickness rates to those most affected. Organizations can be negatively impacted by higher absenteeism rates. The fact that some of the absences appear to be health related (e.g., workers claiming sickness as their reason for their absence), due partially or primarily to stress, is concerning. Considering the previously mentioned physiological effect of general stress (Fraser et al., 1999; McEwan, 2007), stress-related sickness is a possibility. This review found no evidence suggesting a measurable increase in illness due specifically to commuting stress, but I propose there is enough of an association between stress and physiological manifestations to infer some relationship. The efficiency and productivity of workers and, by extension, their organizations will be negatively affected by absenteeism.

Van Ommeren et al. (2011) found that absentee occurrences increased by 12% when commuting 40km as opposed to commuting 10km. Further, they found that if commutes were eliminated entirely, absentee rates would lower by 16%. These data points seem to suggest there is a certain threshold of time or distance (impedance) that creates enough stress to observably impact health. This increase in absentee rates often come in the form of sick days. To that point, Lorenz and Goerke (2015) found that long distance commuters (greater than 50km) take 20% more sick days, middle distance commuters (25-50km) take 12% more, and commuters with commutes less than 25km showed no increase in taken sick days. These “sick days” may not actually represent legitimate illness. Commuting employees may be using the excuse of sickness to simply avoid a long and stressful commute. Magee et al. (2011) observed a clear association between commuting time and sick leave, and they viewed commuting as both stressful and contributing to job strain. Additionally, Magee et al. (2011) contend that this increase in sick days is not always due to sickness but rather is used as a cognitive coping mechanism for individuals who are unduly stressed.

There is additional research that contends that this increase in sick days, due to commuter related stress, involves two possible processes. On the one hand, extra stress from commuting may contribute to an increase in sickness. The hormone most associated with a stress response is cortisol. This particular hormone can have a debilitating effect of the immune response (Randall, 2010). On the other hand, research suggests that some sick days are taken for cognitive recovery or rest (Van Ommeren et al., 2011). In sum, absenteeism is a problem that can potentially affect both the organization and employee, and commuting stress is one contributor to absences from work.

Many researchers have hypothesized that *burnout* is associated with commuting related stress, but few studies have found any data to support that hypothesis. The concept of burnout can be understood as an individual's cognitive response to long-term stressors in the workplace (Nivens & Nordstrom, 2012). Some studies attempted to measure commuting stress to see if it could be considered long-term stressor in an effort to associate it with job burnout. Nivens and Nordstrom (2012) did not find a significant association between commuting stress and job burnout. Their study used the consensus commuting stress determinants (impedance, control, length of commute) and found significant associations between these and commuting stress, but could not correlate commuting stress to burnout. Commuting is a constant factor in most workers daily lives and has been associated with stress response (Navaco et al., 1979; Navaco et al., 1990; Schaeffer et al., 1988); thus, measuring its effect as a long-term stressor seems important.

In summary, commuting has been shown to be associated to a general stress response (Navaco et al., 1979). While there are numerous determinants to the actual process, the most agreed upon are *control*, *length of commute*, and *reliability/predictability* (as described above). The resulting stress can impact work environments in a variety of ways. *Aggression* is one associated outcome that could have negative impacts on organizations. This aggression can be expressed in verbal hostility and obstructionist behaviors (Hennessy, 2008). This could potentially harm workplace relationships and cause a loss in efficiency. *Absenteeism* has also been linked to commuting stress. Research has shown that length of commute (a primary determinant to commuting stress) is associated with higher absentee rates among workers (Knox, 1961). Furthermore, Magee et al. (2011) theorize that many of these absences (taken as sick days) are actually examples of avoidance behavior in order to cope with commuting stress. Although researchers have not been able to make a significant connection between commuting

stress and job burnout, the other workplace outcomes represent serious issues that should be addressed by future research.

### **Theory**

Commuting has been shown to be complex with respect to numerous mental and physiological mechanisms. However, the crux of this review is the impact and influence of commuting stress on workplace outcomes. As mentioned in earlier sections, stress contributes to multiple workplace outcomes. This paper has put forward numerous explanations of why commuting is stressful (e.g., control, length of commute, reliability), but the specific reasons must fit into an accepted theoretical framework of understanding. A lack of control is stressful, but why/how is loss of control stressful? Theoretical frameworks are vital for understanding the overall scope and connection of numerous outcomes within a cohesive network of knowledge.

Navaco et al. (1979) used the transactional stress model (Lazarus, 1966), a widely accepted and highly applicable stress model. The transactional stress model describes the processes of coping with stressful incidents. This model views these incidents as personal-environmental transactions, which are predicated on the impact of an external stressor. This impact is mediated by the person's appraisal of the stressor (primary appraisal) as well as social and cultural resources available (Lazarus and Cohen, 1977). *Primary appraisal* is a person's evaluation of a possible threat. It is an individual's judgment of the significance of the event (e.g., dangerous, positive, stressful, or challenging). Glanz et al. (2008) note that there are often two primary appraisals, perceptions of susceptibility to the threat and perceptions of severity to the threat. These perceptions in turn regulate the strength of coping efforts. Lazarus and Folkman (1984) later found that initial evaluations with high severity or susceptibility can initiate escape or avoidance behaviors. These findings seem consistent with Magee et al.'s (2011) findings that



workplace absenteeism (avoidance behavior) may be a cognitive coping mechanism. Relatedly, Smith and Lazarus (1993) found that when a stressor is evaluated as posing a serious threat or impact on an individual's goals or responsibilities, that person is more likely to experience anxiety – a form of strain. During the commuting experience this appraisal will take the primary commuting stress determinants into account. For example, Lindsey is commuting to work and there is a car accident that causes traffic congestion. In this case she may have lost *control* over her commute (being stuck in traffic), and this is certainly an *unpredictable* event; both of these are factors in experiencing commuting stress. The primary determinants of commuting stress seem to be applicable to the primary appraisal phase of the transactional stress model.

*Secondary appraisal* is an internal evaluation of coping resources and options (Cohen, 1984). This internal assessment addresses how the situation can be “handled.” Some of these resources include, perception of control, perceived ability to regulate one's emotional reactions, and expected outcomes of potential coping mechanisms (Glanz et al., 2008). A related example of these two appraisals could occur as follows. James is in a rush to get to work. He quickly speeds out of his neighborhood only to be stuck in gridlock traffic. He grips the wheel and realizes that this traffic is going to make him late for work (primary appraisal). He considers using a personal day, calling his boss to notify him of his potential tardiness, or get off the highway and try an alternate route (secondary appraisal).

The actions taken to remedy or alter stressful situations would be considered coping mechanisms or coping efforts. These coping mechanisms fall into two categories: problem management and emotional regulation (Glanz et al., 2008). Problem management is focused on how to alter the stressful situation while emotional regulation focuses on changing the cognition resulting from the stressor. These appraisals and coping efforts are exemplified in Figure 1.

Glanz et al. (2008) explains that specific situations exist wherein these coping mechanisms are most effective. For example, problem-focused strategies work best when the stressful situation is changeable, whereas emotion-based coping is most effective when a stressful situation is unchangeable. There are likely other options to deal with commuting-related problems such as riding a bicycle, taking the train, or working from home. However commuting, in a personal vehicle (the most common form of commuting – 86%), seems to fall into the category of unchangeable stressor. An individual stuck in traffic will be unable to significantly alter the situation, thus making any problem-focused coping strategies relatively ineffective. Taylor et al. (1992) found that when a stressful event is perceived as threatening or unmanageable, an individual may have a higher proclivity to partake in disengaging or avoidance-related behaviors. In commuting research this could account for the observed increase in absenteeism. For example, because traffic is bad and James is going to be late for work, he decides to use a sick day and go home. While these coping mechanism reduce initial stress or emotional attention (Suls & Fletcher, 1985), they may eventually lead to higher levels of stress or distress (Carver et al., 1993). For example, James decides to call and use a personal day instead of going to work, this could be seen as an avoidance behavior. James may feel highly susceptible to an uncontrollable threat (traffic) and use avoidance behavior to cope. While this may allow him to regulate his stress and prepare to be well-rested and on time in the following days, he may further ruminate on factors such as his bosses getting irritated or that his work is piling up. This inability to unwind or proclivity to focus on work-related considerations (rumination) is associated with many negative outcomes, as rumination, in general, has been shown to be maladaptive and related to depression (Mathew & Wells, 2004). Additionally, work-related rumination has been associated with poor physical health (Thomsen, Mehlsen, Olesen, Hokland, Viidik, Avulund, &

Zacharae, 2004) and sleep disturbances (Akerstedt, Knutsson, Westerholm, Theorell, Alfredsson, & Kecklund, 2002; Cropley, Dijk, & Stanley, 2006). All of these outcomes (stemming from avoidant behaviors associated with commuting stress) could have negative impacts to workplace environments.

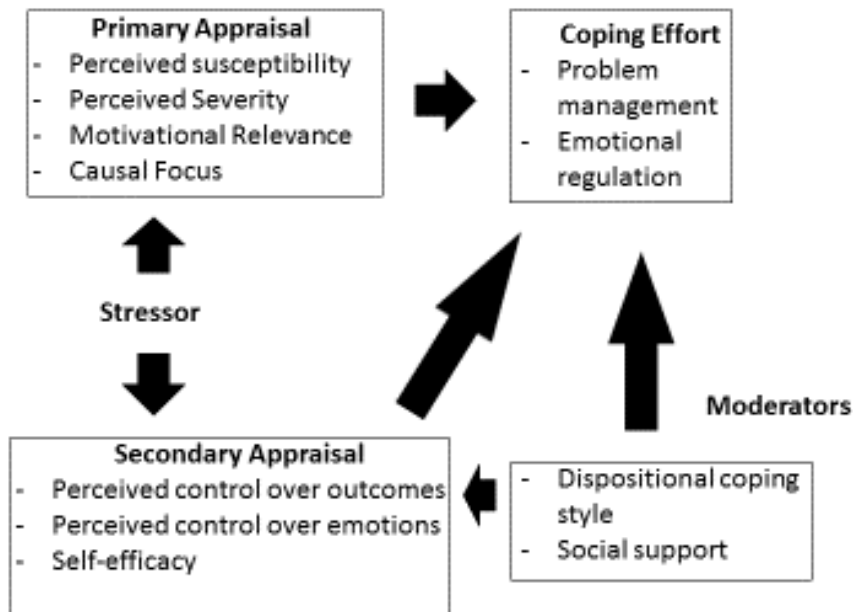


Figure 1. A flow chart of the transactional model of stress and coping (adapted from Glanz et al., 2008, p. 216)

The transactional stress theory has numerous connections to commuting stress experiences. In this review, I previously noted the importance of control with respect to the process of commuter-related stress. Control is widely recognized as one of the most, if not the most, important determinant of commuting stress. There seem to be some parallels between a lack of control and a high susceptibility. For example, when James is stuck in gridlock traffic, he has no control over traffic patterns, accidents, or congestion. This lack of control may make him highly susceptible to feeling strain from the commuting event. If coping efforts lose their efficacy due to threat susceptibility (being stuck in gridlock traffic), there is a good chance James

will experience strain. Furthermore, because traffic congestion is often the result of uncontrollable or unpredictable events (car accidents, construction, weather conditions), James's commute could be unreliable (another determinant of commuting stress), which could lead to greater levels of experienced stress. Lastly, the final destination of the commute and location of the spillover effects could contribute to the seriousness of the threat (e.g., bosses with strict tardiness policies, work deadlines, too many previous absences). These workplace factors may lead to further restricting of coping resources resulting in a more powerful stress response. Once again, problem management coping efforts may not be possible because the source of the stress has already occurred (commuting stress due to traffic congestions) and cannot be manipulated due to its uncontrollable nature. As these coping resources are diminished, there is an increased likelihood of stress occurring.

Contemporary research has shown some analog findings in relation to transactional stress concepts. As previously mentioned, appraisals with high severity or susceptibility can lead to avoidance behaviors (Lazarus and Folkman, 1984). Contemporary research may unintentionally link *length of commute* with threat susceptibility. Recall that Lorenz and Goerke (2015) found that middle distance and long distance commuters showed an increase in workplace absenteeism (12% and 16% respectively) when compared to short distance commuters. This increase in absenteeism could be a representation of avoidance behavior due to *length of commute* contributing to high threat susceptibility (Lazarus & Folkman, 1984). While these avoidance behaviors may provide an immediate cognitive reprieve from a stressor, they run the risk of negatively impacting the individual's workplace. It is a hassle for managers to procure replacement labor or reorganize responsibilities to other employees. In addition, this increased workload for other employees may make work environments more hostile or unfriendly, and this

workplace strain may further exacerbate negative outcomes in the workplace. However, without avoidant coping efforts (calling in sick), people suffering from acute commuting stress may enter the workplace with higher stress levels. This increase in stress may lead to more spillover effects (Hennessy, 2008) and have a deleterious impact on more people than avoidance behavior would.

All that being said, the transactional stress model is not the only stress theory that can be used as framework to understand and explain the mechanisms underlying commuting stress. Conservation of resources (COR) theory (Hobfoll, 1989) is another theory that attempts to conceptualize the stress experience. COR theory represents a resource-oriented framework. It is based on the idea that individuals attempt to retain, protect, and construct resources, and threats represent the possible or actual loss of these valuable resources (Hobfoll, 1989). Hobfoll proposed this model based on his contention that no other stress theory was sufficiently empirical or testable. He viewed the transactional stress model to be overly focused on perception with no way to measure or test individual perception or susceptibility to stressors. Because there exists no true conceptualization of the strength of coping variables or stressful events, one cannot truly measure or calculate how stressful, or not, a specific event is. In COR theory, Hobfoll (1989) defined *stress* as a “reaction to the environment in which there is (a) the threat of a net loss of resources, (b) the net loss of resources, or (c) a lack of resource gain following the investment of resources” (p. 516). In this model, resources are vitally important for defining, measuring, and understanding psychological stress and the events or threats that are associated with it. Hobfoll (1989) defined resources as “objects, personal characteristics, conditions, or energies that are valued by the individual or that serve as a mean for attainment of these objects, personal characteristics, condition, or energies” (p. 516). These resources can be just about anything imaginable. Resources could include: self-esteem, income level, family satisfaction, occupational

prestige, grit, and resourcefulness. Hobfoll suggested that these resources can be threatened or lost due to environmental circumstances. This loss is important for two main reasons: (1) these resources have instrumental value and (2) they possess symbolic value. The instrumental value represents the concrete aspects of these resources (e.g., high income allows an individual to purchase nicer possessions). Symbolic value is more associated with internalized effects. Because resources can be beliefs and cognitions, and they are involved in helping people define themselves (e.g., an individual known for their calm demeanor and self-control who needs to use self-control in a stressful event), losing them could prove consequential.

COR theory proposes that individuals, when confronted with stress, strive to mitigate or minimize the actual or potential loss of resources. This is not entirely different than the transactional stress model previously discussed (Lazarus, 1966). In the transactional stress model, individuals make two appraisals (i.e., primary, secondary) and then use coping behaviors in order to minimize stress or anxiety. However, the transactional stress model does not include propositions pertaining to non-stress induced events. That is, COR theory does make hypotheses about how people prepare for future stressors. COR theory suggests that at times where a stressor is absent, people will attempt to build up a surplus of resources in order to mitigate a future loss of resources due to a stressful event (Hobfoll, 1989).

Hobfoll (1989) originally identified four categories of resources: objective resources, conditions, personal characteristics, and energies. More contemporary research, however, has simplified the concept of resources. The previously discussed definition offered by Hobfoll (1989) explained resources as things of value to individuals. However, because some, seemingly, good resources can have negative outcomes, the concept of value becomes muddled (Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014). Halbesleben et al. (2014) define

resources in a more simplified manner, such that “resources are anything perceived by the individual to help attain his or her goals” (p. 1338). This definition streamlines and focuses the concept of resources into a goal-oriented conceptualization. This goal-oriented distinction disentangles resources from outcomes (value), and clarifies their relationship to the individual (goals). While there is still some ambiguity, it offers an explanation to the variability of resources from person-to-person.

Beyond the concept of resources, COR theory posits that there is a perceptual aspect to resource gain or loss. As previously stated, in the absence of a stressful event, people will attempt to gain resources. Resource investment is a concept that describes the giving of resources (e.g., social support, financial support, closeness, love) with an expected reciprocal relationship. This giving of resources helps build close and more meaningful relationships, and potentially gains significant resources for future stress events. However, when this “investment” does not result in the expected gain of resources, it is usually deemed as a loss (Hobfoll, 1989). A loss of resources can have a negative psychological effect on individuals (Hobfoll, 1989). This loss of resources can come from external and internal threats. Because Halbesleben et al. (2014) define resources as anything that an individual perceives will help attain a goal, threats of resource loss could represent anything that could hinder an individual’s goal. In the case of commuting, the primary goal is likely to arrive at work on time, so any hindrance to that goal (traffic congestion, weather, slow drivers) could constitute a threat of resource loss. The concept of resources may represent a more concrete explanation regarding the experience of stress. While the transactional stress model relies on appraisals and perception in its theory of stress, COR theory offers an instrumental aspect instead of simply perception.

COR theory offers some potentially novel contributions to commuter-related stress research. While resources and responses to stress vary from person-to-person, this model offers reasons why. For example, commuting stress research has come to a consensus that *control*, *predictability*, and *length of commute* all contribute to the experience of stress. These determinants can all be generalized into resource relationships. When a commuter experiences a loss of *control* it could represent a loss of resource in control-oriented personalities. If the goal is to be in control, then an unpredictable loss in commuting control could be seen as a loss in resources. Further *predictability* and *length of commute* could represent a loss resources. The primary objective of commuting is to arrive at work. If that is disrupted and the commute becomes less predictable and takes longer, it is impeding the goal, thereby resulting in a loss of resources. Associated workplace outcomes such as *aggression* or *absenteeism* have been associated with commuter-related stress due to a loss of resources in the commute.

While the transactional stress model offers a map from appraisal to perception to coping, COR theory offers an intermediate step between perception and work associated outcomes. As previously reviewed, the transactional stress model contains two appraisals and then coping efforts. *Primary appraisal* is the initial assessment of significance or seriousness of a potential threat (Glanz et al., 2008). This first evaluation's association with stress is moderated by perceptions of threat severity and threat susceptibility. *Secondary appraisal* is an internal inventory of coping resources available to potentially mitigate a stressful event. Finally, *coping efforts* were described as actions (physical and cognitive) taken to reduce or mitigate potential stress. COR theory could be theoretically applied to some of these processes. For example, in the *primary appraisal* stage, a person possessing a high number of resources may feel less threat susceptibility, thus reducing the amount of commuting stress experienced. A similar synthesis of



theory can be observed in the *secondary appraisal* phase. This is perhaps the best example of the intersection of these two theories. The transactional stress model focuses on the perception and evaluation of resources available for coping, while COR theory views resources as a stress management currency used to overcome stressful events. The primary difference between these theories, in the phase of secondary appraisal, involves the perception of resources (transactional stress model) versus the instrumental use of resources (COR theory). These resources could also represent a third appraisal phase, where personality traits (resources) can moderate the stress event. Figure 2 shows the previous flow diagram of the transactional stress model with the addition of where COR theory may be integrated. Figure 3 highlights the potential for integrating COR theory with the transactional stress model, impacting both appraisals and coping behaviors. The interplay between these theoretical concepts may help interpret the variation of stress experience between individuals. The majority of research this paper reviewed showed that the transactional stress model and conservation of resources are mostly treated as exclusive, stand-alone theories. This paper suggests a potential synthesis between these theoretical models.

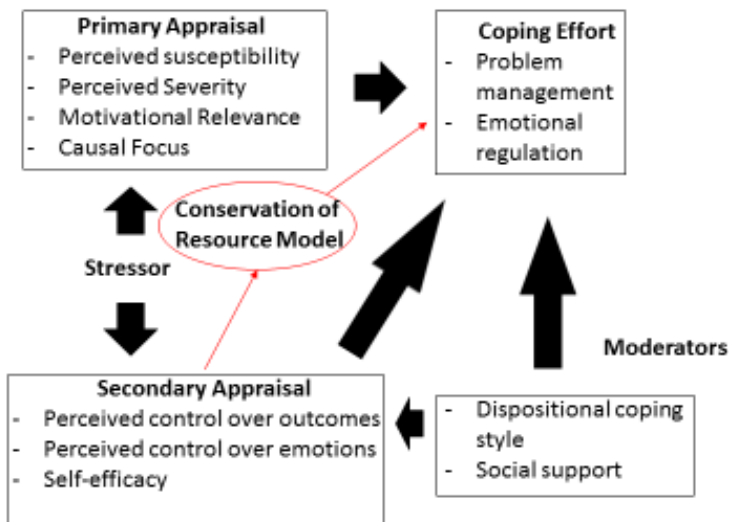


Figure 2. A flow chart of the transactional model of stress and coping with the addition of the conservation of resources model (adapted from Glanz et al., 2008, p.216)

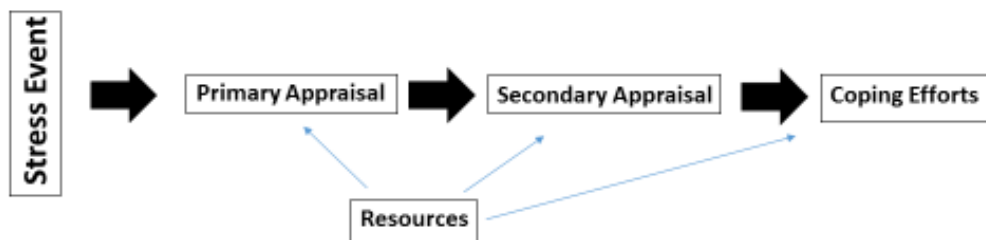


Figure 3. A flow chart synthesizing of the appraisal process of the transactional stress model with the concept of resources from the conservation of resources model

### Common Methodological Approaches

Commuting stress research methodologies have taken different forms. To begin, it is important to distinguish between cross-sectional and longitudinal designs. Cross-sectional designs refer to designs in which data is collected at a single point in time, while longitudinal design gathers data from the same sample across at least two points in time. To date, few commuting stress studies have employed longitudinal designs (Robert et al., 2011; Wener et al., 2005), as such research has employed primarily cross-sectional designs (Hennessy, 2008; Nivens & Nordstrom, 2012; Sposato et al., 2012; Wener et al., 2005; Wener & Evans, 2011). While

longitudinal design may offer more data on how commuting stress unfolds over time, it is more difficult to organize and manage due to tracking study participants and data sources over time.

Like longitudinal designs, experience sampling method (ESM) could prove to be an extremely valuable methodological approach taken by researchers of commuting stress. This particular method captures data from an extremely representative group in their natural environment (Beal, 2015). These sampling designs often include highly involved and repeated assessments followed by short intervals. Generally these studies last 1 to 2 weeks and the intervals between assessments range between hours and a day (Beal, 2015). While there is significant variation between each case of experience sampling method due to the need or choice to employ different intervals or parameters, most ESM have 3 constant elements. These elements include: (1) capturing the experiences in a natural environment (or as close as possible), (2) making immediate or tangible experiences the focus of study over notional or recalled experiences, and (3) evaluating a wide enough range of experiences to accurately indicate an individual's daily life (Beal, 2015). This sampling method is able to measure sequences of events of the chosen group of people. Through intense and repeated assessments ESM is able to differentiate between personal characteristics and event/experience oriented effects. Furthermore, these repeated measures allow researchers to explore the within-person actions as they appear over time (Fisher & To, 2012).

ESM could prove extremely valuable for researching commuting stress. It could help differentiate different types of stressors and aid in the measurement of distinct workplace outcomes as responses to an environmental stressor like commuting. Further, it could offer specific evidence related to the strength of these effects. For example, if a study were assessing stress levels via salivary cortisol before leaving to work, again directly after arriving, and then

throughout the day in addition to assessments on job performance, efficiency, aggression, and communication, researchers could differentiate how specific events (e.g., commuting, interpersonal conflicts, workplace pressure or deadlines) impact work performances or behaviors.

In addition to the aforementioned design elements, participant selection criteria represents another important step in commuter-related stress research. Because researchers are attempting to study a specific kind of stress and its associated effects, they have to selectively choose participants based on a rigorous criteria for inclusion in the study. Most studies used varying combinations of the following criteria: commute (measured in time or distance, often broken into groups by severity of length/distance), length of time regularly commuting (how long have you been commuting “x” miles?), education level, and income level (Gottholmseder et al., 2009; Nivens & Nordstrom, 2012; Sposato et al., 2012; Wener & Evans, 2011). Collecting such demographic information is critical for assessing the generalizability of one study’s findings to the broader population of commuters. In addition, such demographic variables can serve as potential moderators in a focal study or in a subsequent quantitative synthesis (i.e., meta-analytic investigation) of the multiple studies investigating the same phenomenon.

One possible weakness in commuting stress research participant sampling is gender. While commuter-related stress has been shown to exist between genders, women’s higher susceptibility to it (Roberts et al., 2011) makes sampling an important issue. Studies that have an overrepresentation of female respondents or participants, run the risk of inflating their general observed effect. This is especially problematic for studies that do not control for gender within their methodological approach. When studies have an overrepresentation of women and do not control for gender variable effects, they risk the generalizability of their findings. I identified several articles that seemed to sample significantly more women than men (e.g., Hennessy, 2008;

Koslowsky et al., 1996; Sposato et al., 2012). Future research should take deliberate and careful steps when sampling so as to not overlook potential gender effects.

General sample selection should also be addressed in reference to commuting stress and associated work effects. Several studies I reviewed sampled from populations of professional employees (Nivens and Nordstrom, 2012; Roberts et al., 2011; Wener and Evans, 2011), thereby ensuring some degree of generalizability to other populations of professional employees. Other studies, however, have utilized convenience samples of students, who are employed off campus (Hennessy, 2008; Sposato et al., 2012); such samples have several potential problems. First, the samples are made of students without professional degrees, so the employment is likely to be lower paying. This could make commuting relatively more expensive and influence the amount of stress being experienced. Second, the fact that these jobs are likely non-career-oriented, the participants may be less careful in regulating their emotions (influenced by commuter related-stress) than professionals in career-oriented employment. This could lead to an over representation of observed workplace effects.

### **Summary**

This review has examined the historical basis and evolution of commuting stress research. It attempted to synthesize numerous disciplines into a cohesive framework of understanding commuting stress and its workplace impacts. For this review, I examined most closely the workplace outcomes of aggression and absenteeism. The workplace outcomes section also included the most related determinants of commuting stress (control, length of commute, and reliability/predictability of commute). In addition, the transactional stress model was described, along with corresponding research. Finally, this review attempted to show

contemporary findings that were congruous with the aforementioned stress model, as well as COR theory.

### **Discussion**

For the purpose of this review I attempted to capture numerous disciplines (i.e., psychology, sociology, biology, economics, political science, urban planning, and civil engineering) in an attempt to develop a better framework for understanding commuting stress. However, because I attempted to capture such a broad understanding of this particular concept, I may have overlooked articles that examine commuter-related stress in domain-specific ways. Highly in-depth, discipline-specific studies can be difficult to relate to other fields, much less meld into a multidisciplinary framework. For future projects I could conduct discipline specific literature reviews and then attempt to synthesize key findings together. In this way, I would be less likely to overlook any disciplinary specific research relating to my chosen topic. Additionally, I only reviewed spillover effects in one direction (home to work). There is a large body of research, associated with the opposite direction (work to home) that I was unable to properly study for the purpose of this review. Finally, this was simply a review, I did not contribute any new data or novel research findings to the field.

### **Theoretical Implications**

I believe this review has identified analog findings between contemporary commuting stress research, the transactional stress model, and COR theory. As I will comment on later in this discussion, there seems to be a lack in theoretical support in much of commuting research. Numerous studies claim to be influenced by the transactional stress model, even reference it, but fail to explain how their research questions or findings are applicable to any theoretical model. In this review I examined some seemingly parallel, or highly relatable concepts. Control, which is

considered highly associated to commuting stress, could be viewed as a contributing factor to threat susceptibility (primary appraisal). To that point, (un)predictability could be viewed as another contributing factor to threat susceptibility. Additionally, I discussed a possible connection between absenteeism, and avoidance behavior (problem management coping effort) (Glanz et al., 2008). I believe there may be more salient synergy to be discovered by examining commuting stress through a highly focused theoretical lens.

### **Potential Weaknesses**

Commuting stress research does have some participant selection issues that should be addressed in future studies. Researchers should strive to obtain participants within work environments they are attempting to study. Convenience samples of college students pose potential problems when attempting to generalize to professionally employed populations. Furthermore, samples with a disproportionate number of female participants could also impact generalizability. Future research should carefully choose representative and evenly distributed samples of participants.

Another limitation I observed is the relative lack of attention paid to theoretical models. While most articles mention theories, very few attempt to couch their research questions or explain their findings along theoretical models. One could make the argument that commuting stress is new enough that it does not fit perfectly into any existing stress models. However, this argument will prove unsuccessful because the first piece of research on commuting stress based its questions and findings on a specific stress model (e.g., transactional stress model) (Navaco et al., 1979). The transactional stress model and COR theory offer novel insights on the creation and mitigation of commuting stress. While the transactional stress model focuses on individual's internal perceptions and appraisals, COR theory focuses on the instrumental currency that may

dictate those perceptions. I could not find a specific reason of why theory is mentioned so little in the research I reviewed.

### **Future Directions**

I believe that experience sampling methodology (ESM) is an approach that should be used more often in the study of commuting stress. Its ability to rigorously assess and potentially differentiate the effect between stress experiences would likely prove valuable to the field. Further, because these assessments are done in a natural environment, the data gleaned should be easily generalizable to the “real-world.” Data and recommendations found through this method may appear more attractive for organizations to implement due to its focus on natural environment. However, this method is not without its weaknesses. Because of the nature of repeated and intense assessment, it would likely be hard to convince organizations to go along with the increased time and financial demands. The assessments could cause annoyance and loss in productivity especially if a large sample was being studied. However, if an organization is willing, ESM appears to be an ideal research design for capturing specific and within-person effects applicable to commuting related stress. In addition to ESM, I would recommend that future research use more traditional longitudinal designs. Unlike cross-sectional designs, longitudinal designs allow researchers to observe commuting stress at multiple points in time. Because commuting is a constant action for most workers, capturing multiple time points would be valuable in order to observe the long-term effects of commuting stress. This design would also allow for the testing of procedures or interventions for reducing commuting stress.

As a recommendation for future research direction I would recommend that more studies focus on gender-related workplace outcomes, due to commuting stress. For instance, if men use aggression as an instrumental coping mechanism (at work) in order to cope with commuting



stress, what are women's workplace coping mechanisms? Research suggests that women are more at risk for commuting stress, yet I could find no research of female specific spillover effects to work. However, as this review only examined one direction of potential spillover effects (home to work), there may be evidence of female spillover effects to the home.

I would also recommend that researchers pay more attention to framing their research questions and hypotheses using a prominent theory such as the transactional stress model or COR theory. Theoretical applications are important in organizing numerous studies and attempting to explain and understand phenomena. The transactional stress model and COR theory both represent valid and applicable frameworks for the study of commuting stress. This review even offered potential synthesis of these theoretical approaches. Both models offer interesting hypotheses on the experience of stress and why it occurs. New questions and avenues of study may be discovered if researchers choose to apply theory to their statistical findings.

In terms of practical recommendations for commuting employees, I would suggest that people find quality employment as close to their home as possible. If there is absolutely no vocational options in direct proximity, I would suggest moving to an area that does. While this recommendation may seem obvious, it seems to be the only true way to avoid the potential effects of commuting stress and its associated interaction effects in the workplace. In situations where there is absolutely no alternative than to commute, I suggest exploring several potential commuting routes to work. This gives you the chance to alter your commute if one route is subject to an accident or unpredictable delay (increasing potential coping efforts). Another possible solution is to leave home earlier than is necessary. Locate a coffee-shop or a breakfast joint close to work and plan to enjoy a small stop there before work. In this way, if traffic is

especially congested and alternate routes are not viable, you will have a period of time as a buffer before you need to be at work.

### **Conclusion**

The aim of this review was to explain the history and evolution of commuting stress, synthesize applicable research from several disciplines, discuss the workplace effects and examine the theoretical and methodological approaches used to study commuting stress. Through the research of this review, I was able to identify several potential problems within commuting stress methodology and the application of theory. In addition, I attempted highlight specific areas of overlap between contemporary research and theoretical models, and make concrete recommendations to employees and organizations in order lessen commuter-related stress. It is my opinion that future research should reexamine the primary determinants of commuter-related stress (control, length of commute, and predictability/reliability of commute) and their associated stress outcomes within the work environment (aggression and absenteeism) through a gender-variable lens. Furthermore, contemporary studies exploring commuting stress should put more focus on theory. While many of these studies employ sound research designs and methodologies, the lack of theory is notable. Another valuable contribution for future research could be a complete review of the variables, determinants, and interaction effects of commuting stress compared with and applied to different theoretical stress models. This would give future researchers a consolidated piece of work identifying relatable theories to contemporary research.

## References

- Akerstedt, T., Knutsson, A., Westerholm, P., Theorell, T., Alfredsson, L., & Kecklund, G. (2002). Sleep disturbances, work stress and work hours: a cross-sectional study. *Journal of Psychosomatic Research, 53*(3), 741-748.
- Almeida, D. M., Wethington, E., & Kessler, R. C. (2002). The daily inventory of stressful events: an interview-based approach for measuring daily stressors. *Assessment, 9*(1), 41-55.
- Beal, D. J. (2015). ESM 2.0: State of the art and future potential of experience sampling methods in organizational research. *Annual Review of Organizational Psychology and Organizational Behavior, 2*(1), 383-407.
- Bushman, B. J., Bonacci, A. M., Pedersen, W. C., Vasquez, E. A., & Miller, N. (2005). Chewing on it can chew you up: Effects of rumination on triggered displaced aggression. *Journal of Personality and Social Psychology, 88*(6), 969-983.
- Campbell, A., Muncer, S., & Gorman, B. (1993). Sex and social representations of aggression: A communal-agentic analysis. *Aggressive Behavior, 19*(2), 125-135.
- Cantwell, M., Caulfield, B., & O'Mahony, M. (2009). Examining the factors that impact public transport commuting satisfaction. *Journal of Public Transportation, 12*(2), 1-21.
- Carver, C. S., Pozo, C., Harris, S. D., Noriega, V., Scheier, M. F., Robinson, D. S., & Clark, K. C. (1993). How coping mediates the effect of optimism on distress: A study of women with early stage breast cancer. *Journal of Personality and social psychology, 65*(2), 375-390.

- Catalano, R., & Monahan, J. (1975). The community psychologist as social planner. *American Journal of Community Psychology*, 3(4), 327-334.
- Cavanaugh, M. A., Boswell, W. R., Roehling, M. V., & Boudreau, J. W. (2000). An empirical examination of self-reported work stress among US managers. *Journal of Applied Psychology*, 85(1), 65-74.
- Cohen, F. (1984). Coping. *Behavioral health: A handbook of health enhancement and disease prevention*. New York, NY: Wiley.
- Cropley, M., Dijk, D. J., & Stanley, N. (2006). Job strain, work rumination, and sleep in school teachers. *European Journal of Work and Organizational Psychology*, 15(2), 181-196.
- Deslauriers, B. C., & Everett, P. B. (1977). Effects of intermittent and continuous token reinforcement on bus ridership. *Journal of Applied Psychology*, 62(4), 369-375.
- Evans, G. W. (1984). *Environmental stress*. CUP Archive.
- Evans, G. W., Wener, R. E., & Phillips, D. (2002). The morning rush hour predictability and commuter stress. *Environment and behavior*, 34(4), 521-530.
- Evans, G. W., & Stecker, R. (2004). Motivational consequences of environmental stress. *Journal of Environmental Psychology*, 24(2), 143-165.
- Everett, P. B., Hayward, S. C., & Meyers, A. W. (1974). The effects of a token reinforcement procedure on bus ridership. In *Journal of Applied Behavior Analysis*, 7(1), 1-9.
- Feng, Z., & Boyle, P. (2014). Do long journeys to work have adverse effects on mental health? *Environment and Behavior*, 46(5), 609-625.

- Fisher, C. D., & To, M. L. (2012). Using experience sampling methodology in organizational behavior. *Journal of Organizational Behavior*, 33(7), 865-877.
- Fraser, R., Ingram, M. C., Anderson, N. H., Morrison, C., Davies, E., & Connell, J. M. (1999). Cortisol effects on body mass, blood pressure, and cholesterol in the general population. *Hypertension*, 33(6), 1364-1368.
- Gabriel, G., & Liimatainen, M. R. (2000). Mental health in the workplace. *International Labour Organization*. International Labour Organization.
- Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: theory, research, and practice*. Hoboken, NJ: John Wiley & Sons:
- Gottholmseder, G., Nowotny, K., Pruckner, G., & Theurl, E. (2009). Stress perception and commuting. *Health Economics*, 18(5), 559-576.
- Halbesleben, J. R., Neveu, J. P., Paustian-Underdahl, S. C., & Westman, M. (2014). Getting to the “COR” understanding the role of resources in Conservation of Resources theory. *Journal of Management*.
- Hennessy, D. A. (2008). The impact of commuter stress on workplace aggression. *Journal of Applied Social Psychology*, 38(9), 2315-2335.
- Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American psychologist*, 44(3), 513.
- Horowitz, A. D., & Sheth, J. N. Ridesharing to work: a psychosocial analysis/BEBR No. 345. *Faculty working papers; no. 345*

- Knobloch-Westerwick, S., & Alter, S. (2006). Mood adjustment to social situations through mass media use: How men ruminate and women dissipate angry moods. *Human Communication Research*, 32(1), 58-73.
- Knox, J. B. (1961). Absenteeism and turnover in an Argentine factory. *American Sociological Review*, 424-428
- Koslowsky, M. (1997). Commuting stress: Problems of definition and variable identification. *Applied Psychology*, 46(2), 153-173.
- Koslowsky, M., Aizer, A., & Krausz, M. (1996). Stressor and personal variables in the commuting experience. *International Journal of Manpower*, 17(3), 4-14
- Lazarus, R. S. (1966). Psychological stress and the coping process.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.
- Lazarus, R. S., & Cohen, J. B. (1977). Environmental stress. In *Human behavior and environment* (pp. 89-127). Springer US.
- Lazarus, R. S., & Launier, R. (1978). Stress-related transactions between person and environment. In *Perspectives in interactional psychology* (pp. 287-327). Springer US.
- Laurenzi, I. J., & Jersey, G. R. (2013). Life cycle greenhouse gas emissions and freshwater consumption of Marcellus shale gas. *Environmental science & technology*, 47(9), 4896-4903.
- 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.

- Lorenz, O., & Goerke, L. (2015, April). Commuting and Sickness Absence. Paper presented at the CESifo area conference on employment and social protection, Munich, 8-9 April. Retrieved May 15, 2016, from EconStor.
- Magee, C., Stefanic, N., Caputi, P., & Iverson, D. (2011). Occupational factors and sick leave in Australian employees. *Journal of Occupational and Environmental Medicine, 53*(6), 627-632.
- Matthews, G., & Wells, A. (2004). Rumination, depression, and metacognition: The S-REF model. *Depressive rumination: Nature, theory and treatment, 125-151*.
- Maxwell, J. P. (2004). Anger rumination: an antecedent of athlete aggression? *Psychology of Sport and Exercise, 5*(3), 279-289.
- McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological reviews, 87*(3), 873-904.
- McKenzie, B., & Rapino, M. (2011). *Commuting in the United States: 2009*. US Department of Commerce, Economics and Statistics Administration, US Census Bureau.
- Novaco, R. W., Stokols, D., Campbell, J., & Stokols, J. (1979). Transportation, stress, and community psychology. *American Journal of Community Psychology, 7*(4), 361-380.
- Novaco, R. W., Stokols, D., & Milanese, L. (1990). Objective and subjective dimensions of travel impedance as determinants of commuting stress. *American journal of community psychology, 18*(2), 231-257.
- Nivens, V., & Nordstrom, C. R. (2012). The effect of workers' driving commute on stress and burnout. *Psychology Journal, 9*(2), 73-83.

- Olson Jr, M. (1969). Community values, social measurement, and transportation policy. *Highway Research Board Special Report*, (95-106).
- Podsakoff, N. P., LePine, J. A., & LePine, M. A. (2007). Differential challenge stressor-hindrance stressor relationships with job attitudes, turnover intentions, turnover, and withdrawal behavior: A meta-analysis. *Journal of Applied Psychology*, 92(2), 438-454.
- Randall, M. (2010). The physiology of stress: cortisol and the hypothalamic-pituitary-adrenal axis. *Dartmouth Undergraduate Journal of Science*, 13(1), 22-24.
- Roberts, J., Hodgson, R., & Dolan, P. (2011). "It's driving her mad": Gender differences in the effects of commuting on psychological health. *Journal of Health Economics*, 30(5), 1064-1076.
- Schaeffer, K. H., & Sclar, E. (1980). *Access for all: transportation and urban growth*. New York, NY: Columbia University Press.
- Schaeffer, M. H., Street, S. W., Singer, J. E., & Baum, A. (1988). Effects of control on the stress reactions of commuters. *Journal of Applied Social Psychology*, 18(11), 944-957.
- Smith, C. A., & Lazarus, R. S. (1993). Appraisal components, core relational themes, and the emotions. *Cognition & Emotion*, 7(3-4), 233-269.
- Sposato, R. G., Röderer, K., & Cervinka, R. (2012). The influence of control and related variables on commuting stress. *Transportation Research Part F: Traffic Psychology and Behaviour*, 15(5), 581-587.
- Suls, J., & Fletcher, B. (1985). The relative efficacy of avoidant and nonavoidant coping strategies: a meta-analysis. *Health psychology*, 4(3), 249-288.



- Taylor, S. E., Kemeny, M. E., Aspinwall, L. G., Schneider, S. G., Rodriguez, R., & Herbert, M. (1992). Optimism, coping, psychological distress, and high-risk sexual behavior among men at risk for acquired immunodeficiency syndrome (AIDS). *Journal of personality and social psychology*, *63*(3), 460-473.
- Thomsen, D. K., Mehlsen, M. Y., Olesen, F., Hokland, M., Viidik, A., Avlund, K., & Zachariae, R. (2004). Is there an association between rumination and self-reported physical health? A one-year follow-up in a young and an elderly sample. *Journal of Behavioral Medicine*, *27*(3), 215-231.
- Turner, R. J., Wheaton, B., & Lloyd, D. A. (1995). The epidemiology of social stress. *American Sociological Review*, *60*(1), 104–125.
- Van Ommeren, J. N., & Gutiérrez-i-Puigarnau, E. (2011). Are workers with a long commute less productive? An empirical analysis of absenteeism. *Regional Science and Urban Economics*, *41*(1), 1-8.
- Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of comparative neurology and psychology*, *18*(5), 459-482.
- Wener, R., Evans, G., & Boatley, P. (2005). Commuting stress: psychophysiological effects of a trip and spillover into the workplace. *Transportation Research Record: Journal of the Transportation Research Board*, (1924), 112-117.
- Wener, R. E., & Evans, G. W. (2011). Comparing stress of car and train commuters. *Transportation Research Part F: Traffic Psychology and Behaviour*, *14*(2), 111-116.