

Commuting Demands and Appraisals: A Systematic Review and Meta-Analysis of Strain and Wellbeing Outcomes

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Abstract

Research on commuting to work and its potential consequences for employee strain and wellbeing has accumulated across various disciplines. However, this has led to a narrow research scope with wide methodological variability. An integration of this literature is needed to understand the breadth of the commuting experience and interpret heterogeneous findings. Extending the transactional stress model, we propose that commuting is a demand that can have both negative and positive effects on outcomes through commuting appraisals. We present a systematic review ($k = 109$ studies) and meta-analysis ($k = 39$ studies) of these relationships. Our systematic review finds partial support for our hypotheses, and our meta-analysis suggests that objective commuting demands are positively associated with strain outcomes ($\bar{r}_{xy} = .089$; especially perceived stress, $\bar{r}_{xy} = .153$), but unrelated to wellbeing outcomes. Subjective commuting appraisals are unrelated to strain or wellbeing outcomes. We conclude with recommendations for methodological improvements and implications for research and practice.

Keywords: commuting, stress, strain, systematic review, meta-analysis

Plain Language Summary

Commuting is a nearly ubiquitous part of contemporary employment. Over the last several decades, empirical research on commuting has accumulated across various disciplines. Our systematic review and meta-analysis take stock of relationships regarding commuting demands, appraisals of commuting, and strain- and wellbeing-related outcomes. The results of the qualitative review indicate that there are both positive and negative implications of commuting. Commuting demands are related to favorable and unfavorable appraisals, and commuting demands are also related to both strain and wellbeing outcomes. However, the result of our quantitative meta-analysis suggests that time spent commuting is positively associated with strain outcomes, but unrelated to wellbeing outcomes. Subjective commuting appraisals are unrelated to strain and wellbeing outcomes. We outline implications for future research (e.g., commuting's role in boundary management), highlight methodological challenges (e.g., variability in reporting), and provide recommendations for practice (e.g., offer resources that mitigate consequences of commuting).

Commuting Demands and Appraisals: A Systematic Review and Meta-Analysis of Strain and Wellbeing Outcomes

Commuting refers to the activities involved in traveling some distance from one's home to their place of work and back (Koslowsky et al., 1995). Recent estimates suggest that the number of commuters and distance traveled to and from work has been on the rise in industrialized countries over the last several years (e.g., The Local, 2021). In the United States, for example, the average employee spends more than nine full calendar days of their year commuting, and the number of people "super commuting" over 90 minutes every day has increased by 32% over the past decade (Ingraham, 2019; Wade, 2019). Now, approximately two years after the COVID-19 pandemic first required widespread remote work, employees have reported that they fear and dread their commutes as they slowly return to the office (Cohen, 2021; Otte, 2021; Prudente, 2021). However, some employees have embraced the shift back to the office, saying that they have missed their commuting rituals and the benefits of using the commute as a "transitional buffer" between their work and personal lives (Fowler, 2020; Kaysen, 2020). Owing to its potential implications for both employee strain (e.g., burnout, perceived stress) and wellbeing (e.g., satisfaction, perceived health), the study of commuting is of broad interest to organizational science and practice.

With an increase in the number of empirical studies on commuting over the past few decades, several narrative literature reviews have broadly summarized commuting research and its individual- and work-related outcomes (e.g., Calderwood & Mitropoulos, 2021; Chatterjee et al., 2020; Norgate et al., 2019; Novaco & Gonzalez, 2009). These reviews suggest a multidisciplinary consensus regarding the implications of commuting on the individual; specifically, long and stressful commutes are associated with undesirable outcomes (e.g., Nie &

Sousa-Poza, 2018; Olsson et al., 2013; Rüger et al., 2017) and have pervasive, detrimental effects on strain and wellbeing (e.g., Martin et al., 2014; Wener et al., 2005). However, there is also emerging evidence suggesting that commuting is not universally “bad,” and that commuting may sometimes even benefit wellbeing—for instance, when employees use the time to prepare for or recover from work (e.g., Flynn, 2017; Nicholls et al., 2018). Although decades of organizational research have recognized commuting as a significant *stressor* in employees’ lives, which implies generally negative consequences for individual wellbeing (e.g., Koslowsky et al., 1995; Novaco et al., 1990), we frame commuting more broadly as an *external demand* to account for both the potential detriments *and* benefits of commuting (e.g., Yang et al., 2018). This is a relatively novel consideration, as most studies focus on the negative implications of commuting (e.g., theorizing that commuting is positively related to strain and negatively related to health and wellbeing outcomes). According to the transactional stress model (Lazarus & Folkman, 1984), external demands that are not considered irrelevant can be appraised either as potentially harmful threats or positive challenges, with negative or positive consequences, respectively. As such, in the present work, we focus on objective and subjective commuting demands, subjective commuting appraisals, and both negative (i.e., high strain, low wellbeing) and positive (i.e., low strain, high wellbeing) implications of commuting.

Despite past narrative reviews, the literature on commuting lacks a systematic, formal integration of commuting demands, appraisals, and strain and wellbeing outcomes. Existing narrative reviews are typically either nonuniform (e.g., mixed samples with college students and employees; Davis, 2007) or have a narrow focus that only highlights a portion of extant findings (e.g., subjective wellbeing as the only criterion; Chatterjee et al., 2020). The multidisciplinary nature of this literature (e.g., studies from psychology, economics, public health) is a challenge

to comprehensively integrate because it entails variability in conceptualizations, operationalizations, research designs, relationships studied, and implications of findings. Despite this challenge, comprehensively integrating the commuting literature is necessary for highlighting gaps in the literature, as well as contributing to our understanding of commuting and its relationship with employee strain and wellbeing outcomes. Therefore, we contribute to the organizational psychology literature in three important ways. First, we help bridge the gaps between disciplines and direct a shared research agenda amongst them by presenting a theory-based consolidation of research on commuting, strain, and wellbeing with an integrative conceptual model and an exhaustive narrative review. Second, we address the presence of competing (i.e., positive and negative) and nonsignificant statistical results (e.g., Ingelfield et al., 2018; Lorenz, 2018; Morrow, 2010) by providing a quantitative synthesis of reported zero-order relationships between objective commuting demands (i.e., time spent commuting), appraisals, and strain and wellbeing outcomes. Third, based on findings from our narrative and quantitative reviews, we offer guidance for future theory development and inform evidence-based practical applications.

We structure this paper by first presenting the theoretical background of our conceptual model on objective and subjective commuting demands, subjective appraisals of commuting, as well as strain and wellbeing outcomes (see Figure 1). Second, based on this model, we present the methods and results of our systematic review on direct, indirect, and conditional relationships between commuting demands and various strain and wellbeing outcomes. Third, we summarize the methods and results of our meta-analysis, which provides a quantitative synthesis of associations among (a) objective commuting demands (i.e., time spent commuting) and strain and wellbeing outcomes, as well as (b) subjective appraisals (e.g., perceived commute stress,

commute satisfaction) and strain and wellbeing outcomes. We also explore conditional relationships, based on (c) the moderating role of commute mode (i.e., means of transport to and from work). Although there is a need to better understand how, why, and under which conditions these relationships occur, we are, to some extent, limited in our ability to expand upon various mechanisms and boundary conditions implied by our model because of the scope and depth of the research available in this literature. For example, due to an insufficient number of studies present in the literature that met our inclusion criteria, we were not able to include subjective commuting demands and resources in our meta-analysis, nor were we able to meta-analytically test the indirect effects proposed by our model. Thus, we conclude by highlighting the gaps and limitations that exist in the current commuting literature based on our theoretically grounded model and providing recommendations for future research and practice in this area.

Commuting Demands and Appraisals

Influential early works on commuting borrow from a variety of related stressor-strain and self-regulation theories. Using a person-environment interaction approach, Novaco et al. (1979) introduced the concept of impedance in their commuting model. In this model, *objective impedance* was described in terms of two physical parameters, "... (a) the distance traveled between origin and destination, and (b) the amount of time spent in transit between these points" (Novaco et al., 1979, p. 364). Likewise, *subjective impedance* is the perception of commuting constraints (e.g., subjective evaluations of the commuting experience, perception of control; Koslowsky et al., 1995). Informed by Novaco et al. (1979), the model developed by Koslowsky et al. (1995) sought to codify relationships between commuting as a stressor and strain outcomes, along with various mediators (e.g., perceived stress) and moderators (e.g., time urgency) of these relationships.

Although Novaco et al. (1979) and Koslowsky et al. (1995) laid an important theoretical groundwork for the commuting literature, we deviate from these traditional frameworks to avoid conceptualizing commuting solely as a stressor, which implies only negative consequences thereof. While maintaining that commuting demands can be operationalized using both objective indicators and subjective experiences, we map our findings and future research suggestions onto a model that incorporates the tenets of transactional stress theory (e.g., Lazarus & Folkman, 1987). This model allows us to depict the person-environment transaction of commuting demands and individual subjective appraisal processes (e.g., perceived commuting stress; see Figure 1), as well as their implications for strain and wellbeing outcomes.

Transactional Stress Model

Drawing from the transactional stress model, particularly the notion of stress appraisals (e.g., Lazarus & Folkman, 1984, 1987), we suggest that employees can evaluate their commute in different ways which, in turn, may evoke negative (i.e., strain) or positive (i.e., wellbeing) outcomes. The transactional stress model suggests that individuals are confronted with various situations (i.e., objective or subjective demands) which are then evaluated or appraised as positive or negative events, or even as irrelevant. After this primary appraisal, a secondary appraisal is used to determine what coping options are available. Thus, events, such as commuting to and from work, can be appraised as stressful and possibly negative, or as challenging and possibly positive, and therefore may yield negative *or* positive strain- and/or wellbeing-related outcomes. We borrow from the transactional stress model to develop our conceptual model (see Figure 1) which captures the breadth of commuting experiences by linking antecedent (i.e., objective and subjective commuting demands), intermediary (i.e.,

favorable and unfavorable subjective commuting appraisals), and outcome (i.e., strain and wellbeing) variables.

Our conceptual model's antecedents are defined as objective and subjective commuting demands. To this end, *objective commuting demands* are commuting stressors that are not related to the commuter's perception (e.g., actual time spent commuting from home to work), whereas *subjective commuting demands* involve perceptions regarding the demanding nature of the commute (e.g., perceptions of the traffic congestion on the way to work). In line with the transactional stress model, we also conceptualize commuting appraisals as intermediary mechanisms linking (objective and subjective) commuting demands to individual-level (i.e., strain and wellbeing) outcomes. On the one hand, we define *unfavorable commuting appraisals* as the evaluation of commuting demands as threats or losses. On the other hand, we define *favorable commuting appraisals* as the evaluation of commuting demands as challenges (Lazarus & Folkman, 1987). Finally, our criterion is also parsed into individual-level outcomes with positive or negative valence. We define *wellbeing outcomes* as desirable outcomes with positive valence, and *strain outcomes* as undesirable outcomes with negative valence.

As an illustration of the proposed model, consider the possibility that, within their primary appraisal of the commute, some may appraise their commute as a positive experience, whereas others view it as stressful, or even as irrelevant. The transactional stress model suggests that, as part of a secondary appraisal process, individuals also evaluate the resources available for coping with the stressor, particularly if they perceive a stressful relationship with their environment (Lazarus & Folkman, 1984). These evaluations (i.e., primary and secondary appraisals) influence strain and wellbeing reactions (Lazarus & Folkman, 1984). Importantly, whereas the influence of commuting demands on appraisals should be similar regardless of

whether the demands are objective or subjective in their nature, our model suggests that differential appraisals of these demands (i.e., as favorable or unfavorable) are countervailing mechanisms that (partially) account for differential positive and negative relationships between commuting demands and strain and wellbeing outcomes.

Thus, aligned with the transactional stress model, we propose that objective commuting demands (e.g., time spent commuting, distance traveled) and subjective commuting demands (e.g., perceived traffic congestion) are associated with subjective commute appraisals (i.e., viewing commuting as stressful; experiencing positive feelings about commuting) which, in turn, are associated with strain and wellbeing (see Figure 1). Although not directly addressed here (owing mostly to the contemporary state of the literature, which prevents them from being considered in our review), our model also borrows the notion of coping strategies as a moderator of relationships between appraisals and strain and wellbeing outcomes, and commuting resources as a predictor of the use of such strategies. To this end, *commuting resources* entail commute-related factors that help employees to address commuting demands (e.g., the ability to exert personal control over commute mode), whereas *coping strategies* involve employees' actions that help to reduce strain and increase wellbeing associated with the commute. We additionally consider these variables in our model in service of presenting a more complete treatment of transactional stress theory as it would apply to the commuting context and to inspire future research to consider not only the mechanisms of commuting demands (i.e., appraisals) but also the intrapersonal conditions (i.e., coping strategies and their antecedent commuting resources) that differentially affect the experience of commuting on strain and wellbeing outcomes.

Consistent with the theorizing outlined above and our conceptual model, the overarching hypotheses guiding the present work are outlined next. Our methods and certain hypotheses were

pre-registered: <https://osf.io/gp6ks..> We clarify deviations from this pre-registration where relevant (see online supplementary material [OSM]: <https://osf.io/z87qg/>

Although our conceptual model considers both the positive and negative implications of commuting through favorable and unfavorable appraisals (respectively; see Figure 1), we focus first on the prevailing prediction regarding the direct influence of commuting demands on strain and wellbeing outcomes:

Hypothesis 1: Commuting demands (i.e., objective demands, such as commuting time, and subjective demands, such as perceived traffic congestion) are (a) positively associated with strain outcomes and (b) negatively associated with wellbeing outcomes.

Hypothesis 2: Commuting demands are (a) positively associated with unfavorable subjective commuting appraisals outcomes (e.g., perceived commuting stress) and (b) negatively associated with favorable subjective commuting appraisals (e.g., commute satisfaction).

Moreover, consistent with the transactional stress model, our conceptual model offers that (favorable and unfavorable; see Figure 1) subjective commuting appraisals serve as countervailing mechanisms that indirectly account for differential (i.e., positive and negative) relationships between commuting demands and strain and wellbeing outcomes:

Hypothesis 3: Unfavorable subjective commuting appraisals are (a) positively associated with strain outcomes and (b) negatively associated with wellbeing outcomes.

Hypothesis 4: Favorable subjective commuting appraisals are (a) negatively associated with strain outcomes and (b) positively associated with wellbeing outcomes.

Hypothesis 5: Unfavorable subjective commuting appraisals mediate the relationship between commuting demands and (a) strain outcomes and (b) wellbeing outcomes.

Hypothesis 6: Favorable subjective commuting appraisals mediate the relationship between commuting demands and (a) strain outcomes and (b) wellbeing outcomes.

Method

We present both a systematic narrative review and a meta-analysis, which allows for more valid conclusions than previous narrative reviews on commuting (Hodgkinson & Ford, 2014). Although there is a sizeable literature on commuting, strain, and wellbeing outcomes, there is a great deal of conceptual and methodological variability in the ways in which commuting is studied. This is in part due to the multidisciplinary nature of the commuting literature (e.g., psychology, public health, economics) and different norms across fields. Thus, many studies qualify for inclusion in our systematic review, whereas only a subset of these studies meet the more stringent criteria for our meta-analytic review. Therefore, in the following, we provide a broad and inclusive systematic review that is then supplemented with a more focused quantitative meta-analytic review.

To be included in our systematic review, studies must have considered associations between objective or subjective commuting demands or subjective commuting appraisals and strain and/or wellbeing outcomes. For the meta-analysis, included studies had to also be empirical, quantitative, and report appropriate effect size estimates (i.e., zero-order correlations between commute variables and strain and/or wellbeing outcomes). We conducted a preliminary literature search in the summer of 2020 using iterative keyword searches (e.g., “commut* AND strain”; see OSM for details) and forward and backward searches (e.g., articles citing “Novaco et al., 1979”) across several search engines and databases (e.g., Google Scholar, APA PsycINFO, PubMed). To explore all relevant scientific works, our search was not limited to peer-reviewed publications, but also included dissertations, theses, and conference papers. This initial search

resulted in $k = 54,426$ studies that were screened by title, abstract, and full text. For abstract and full text screening, two members of the research team individually reviewed studies, compared decisions about inclusion or exclusion, and came to consensus on whether the study at hand was to be included in the systematic or meta-analytic review. This process resulted in an initial set of $k = 92$ studies for our systematic review. Of these $k = 92$ studies, $k = 23$ also met the inclusion criteria for our meta-analysis.

An expanded literature search was conducted in Spring 2021 to capture additional studies and effect sizes. Iterative keyword searches (e.g., “commute variability,” “commuting,” and “perceived time pressure,” “commuting” and “perceived traffic congestion”) were completed in Google Scholar and APA PsycINFO. This process resulted in an additional $k = 17$ studies added to the database for the systematic review. While completing the extended search, we also reviewed Davis (2007), an unpublished master’s thesis with similar meta-analytic hypotheses, and we conducted a backward search of the studies included in this quantitative analysis (see OSM for more details). We also emailed the authors of included quantitative studies asking for data if their paper did not report zero-order correlations but appeared to have collected data on variables relevant to this review. Finally, we queried data repositories (i.e., inter-university consortium for political and social research; ICPSR) searching for commute variables (i.e., “commute time”), which resulted in an additional $k = 6$ sources added to the meta-analysis. Our systematic review includes $k = 109$ sources, our quantitative review of objective commuting demands is based on 204 effect sizes, derived from $k = 39$ studies, representing $n = 77,809$ employees, and our quantitative review of subjective commuting appraisals is based on 10 effect sizes, derived from $k = 6$ studies, representing $n = 1,679$ employees. Notably, all $k = 6$ studies that considered subjective commuting appraisals also considered objective commuting demands

(i.e., commute time), thus in total our meta-analytic database represents $k = 39$ unique studies (see Figure 2 for a PRISMA-style flowchart of this literature search process).

In an initial round of coding, the research team coded commuting variables as either objective commuting demands (e.g., time spent commuting, distance traveled while commuting, comparisons between mode of commuting) or subjective commuting appraisals (e.g., perceptions of commute experiences). In line with early influential work in the commuting literature (e.g., Koslowsky, 1997), variables were coded as “objective” if they captured stimuli that were not related to one’s perceptions or “subjective” if they involved cognitive and emotional processing by the commuter. Strain and wellbeing outcome variables were also coded as objective (e.g., days sick, body mass index) or subjective (e.g., perceived stress, positive affect). A second round of coding was separately completed for the meta-analysis and involved coding criterion variables into criterion categories, that included strain outcomes and wellbeing outcomes. Consistent with the occupational health psychology literature (e.g., Taris & Kompier, 2014), we consider both strain and wellbeing to be individual outcomes of objective/subjective demands and subjective stress appraisals. Strain and wellbeing represent “two sides of the same coin;” whereas strain includes generally negative or undesirable psychological experiences (e.g., negative affect; perceived stress), wellbeing entails generally positive or desirable psychological experiences (e.g., physical health; life satisfaction). Accordingly, we coded criterion variables as a strain or a wellbeing outcome depending on their valence or desirability. To this end, strain outcome variables were classified as those that have a generally negative valence, whereas wellbeing outcome variables were classified as those that have a generally positive valence.

Results

To present the results of our systematic review in a reader friendly and accessible format, we have built a supplementary website that includes both a dynamic table (i.e., searchable for keywords; sortable by heading categories) and interactive results map that summarize the $k = 109$ studies included in our systematic review (see https://sluseallab.github.io/commuting_review). Given the sheer number of studies included in this review, we do not discuss each study here. Rather, in the following, we organize the presentation of selected studies by the components of the transactional stress model (Lazarus & Folkman, 1987) represented in our conceptual model (see Figure 1). More specifically, we discuss studies that report relationships that correspond to the direct and indirect pathways depicted in our model (e.g., commuting demands and subjective commuting appraisals, subjective commuting appraisals and outcomes, commuting demands and outcomes via subjective commuting appraisals) and reflected in our hypotheses. Following this summary of the results of representative studies within these categorizations, we present the quantitative results from the meta-analysis of a more limited number of relationships between objective commuting demands (i.e., commuting time) and subjective commuting appraisals and strain and wellbeing outcomes.

Systematic Review Results

Our systematic review of the commuting literature across multiple disciplines suggests that commuting is commonly investigated as a predictor of adverse outcomes for employees traveling to and from their workplace. Commuting is operationalized in many ways and, although multiple studies assess similar demand-strain relationships (e.g., commute time and perceived stress), measurement and analyses are rarely parallel. Objective commuting demands (e.g., commute time, commute distance, comparisons across various commute modes) were the most common predictors (252 relationships), followed by subjective commuting appraisals (e.g.,

perceived commute stress) (72 relationships). Most studies included in our review predicted that objective commuting demands and unfavorable subjective commuting appraisals increased strain outcomes (Hypotheses 1a and 3a) and decreased wellbeing outcomes (Hypotheses 1b and 3b). In most cases, this was empirically supported. Albeit infrequently, favorable subjective commuting appraisals were generally found to have negative associations with strain outcomes (Hypothesis 4a) and positive associations with wellbeing outcomes (Hypothesis 4b).

While organizing findings presented within the literature, it became evident that the “full picture” of commute experiences is far from clear. For several decades, this area of research has focused on how commuting serves as a stressor that results in strain and negative evaluations of the commute. Some studies in our review extended their analyses beyond direct effects and zero-order correlations (e.g., subjective commuting appraisals as moderators of stress-strain relationships), but only a handful implement formal mediation analyses to test the processes implied by our conceptual model (see Figure 1). Our systematic review calls attention to important relationships that have been neglected, despite their potential to explain *why* commuting experiences may vary. For example, we suspected that commute mode was likely to play a moderating role in commute relationships; however, research has not explored its impact as such. Thus, our systematic review was not able to discuss findings on this topic given its absence of being formally treated as a moderator in primary studies found in this literature. However, we can approximate tests of this idea in our meta-analysis, reported below.

Hypothesis 1a and 1b: Commuting Demands and Strain/Wellbeing. Objective commuting demands included commute time, commute distance, commute speed (e.g., average miles per hour), commute mode (e.g., comparisons between different commute modes, such as active vs. passive or car vs. public transportation), and frequency of traffic congestion, and

subjective predictors included commute predictability, commute variability, perceived time pressure, and perceived traffic congestion. Furthermore, outcomes included measures of poor health-, family-, and job-related variables. The direct relationships between objective commuting demands and strain and wellbeing outcomes are heavily researched, such that most relationships included in our systematic review fall into these two paths of our model. Relationship between subjective commuting demands and these outcomes are (relatively speaking) less common in the literature, but still represented. For example, perceived traffic congestion and commute variability were related to higher perceived stress (Gottholmseder et al., 2009; Haider et al., 2013). We found partial support for these hypotheses due to several reports of positive relationships between objective commuting demands and wellbeing (contradicting Hypothesis 1b).

Commute time was found to be related to sick leave for low-income women (Karlström & Isacson, 2010), increased body mass index (Jun et al., 2019), less physical exercise (Nomoto et al., 2015), less sleep (Nomoto et al., 2015), and general absenteeism (Ma & Ye, 2019). Urhonen and colleagues (2016) found that those who had longer commutes for an extended period (i.e., more than 11 years) had more health complaints than those with longer commutes for shorter periods (i.e., less than 2 years). In one of the few qualitative studies in the commuting literature, participants who had longer commute times discussed having less personal time for themselves and less flexibility within their day (Flynn, 2017).

Although several studies found support for negative health outcomes, not all studies found significant relationships (e.g., commute time and body mass index, Sha et al., 2019). Longer commutes (e.g., more time spent commuting) were also related to subjective strain-related criteria for health outcomes, work outcomes, and family outcomes. Commute duration

was associated with higher perceived stress (Gottholmseder et al., 2009; Haider et al., 2013), lower life satisfaction (Jun et al., 2019; Kleinfehn, 2016; Nie & Sousa-Poza, 2018), lower job satisfaction (Crawley, 2014; Roberts et al., 2011; Sun et al., 2020), poorer mental health and subjective wellbeing (Roberts et al., 2011; Stutzer & Frey, 2008), poorer perceived health (Sun et al., 2020; Urhonen et al., 2016), greater intent to quit (Morrow, 2010), and higher work-family conflict (Morrow, 2010). Finally, one study investigated indirect effects of objective commuting demands on wellbeing (albeit not as depicted in our model). Specifically, Hilbrecht et al. (2014) reported that commute time decreased life satisfaction through the subjective demand of perceived traffic congestion.

Commute distance has been shown to be linked to objective strain-related measures such as being overweight (Nicholls et al., 2017), smoking behaviors (Rubin, 2018), sickness absences (Goerke & Lorenz, 2017), and a higher risk of mortality (Sandow et al., 2014). However, these relationships were often moderated by other variables (e.g., age, Rubin, 2018; income, education, and gender, Sandow et al., 2014; decreased physical activity, Nicholls et al., 2017). Schaeffer et al. (1988) included commute speed as a predictor in their model and found that higher commute speed (i.e., miles per hour) related to increased blood pressure. Although only one study used frequency of traffic congestion as a predictor, Haider et al., (2013) reported that it was related to increased stress. Conversely, commute distance was not found to increase perceived time pressure, nor did commute distance increase smoking behaviors through perceived time pressure (Rubin, 2018).

Comparisons across different modes of commuting were also found to be influential; for example, nurses using public transportation were more willing to change their job than those using private transportation (i.e., their own car; Festini et al., 2011). Although a physically active

commute mode (e.g., biking to work, walking to work) was commonly evaluated in terms of the benefits of active commuting, one study found that women who actively commute were more likely to be sedentary while at work (Ohta et al., 2007). Finally, some papers that included multiple studies did not find consistent relationships across studies (e.g., commute time and job satisfaction, Morrow, 2010). Some studies noted these relationships were dependent on other variables (e.g., income, Crawley, 2014; gender, Roberts et al., 2011; satisfaction with salary, Sha et al., 2019), but other findings were more generalizable (e.g., commute time had a significantly negative relationship with life satisfaction for both men and women, non-dual earner households, and employees with varying levels of income, Jun et al., 2019).

Although we hypothesized a negative relationship between objective commuting demands and wellbeing (Hypothesis 1b), we found three studies that reported positive associations between the two variables. These findings add value to the literature, especially in terms of the benefits of active commuting (e.g., walking or biking to work). Ma and Ye (2019) found that for middle-aged participants, active commuting was significantly related to increased job performance. Hendriksen et al. (2010) found that active commuters (i.e., cyclists) were absent for fewer days compared to non-active commuters. However, these results pertain to participants that already reported good or excellent health. Beyond commute mode, Nicholls et al. (2018) found that long distance commuting can have a positive social impact for employees by strengthening new, external social networks.

Hypothesis 2a and 2b: Commuting Demands and Unfavorable/Favorable Subjective Commuting Appraisals. Several studies in the commuting literature have reported relationships between objective (e.g., time, distance, mode) and subjective (e.g., perceived traffic congestion) commuting demands and unfavorable appraisals of the commute, showing partial support for

Hypothesis 2a. For example, although commute time (i.e., an objective demand) is associated with lower levels of commute happiness, the associated subjective demand of commute unpredictability had a larger negative impact on employees' commute happiness (Denstadli et al. 2017; Nicholls et al., 2017). Other research has likewise concluded that longer commutes predict less satisfaction with the commute (Denstadli et al., 2017; Nicholls et al., 2017).

Only a few studies evaluated relationships between objective commuting demands and favorable subjective appraisals of the commute, showing partial support for Hypothesis 2b. Furthermore, each of these studies primarily focused on comparisons among commute modes as a demand. For example, active commuters (e.g., biking, walking) rated their commute as less stressful (Rissel et al., 2014) and had more positive feelings about commuting (Flynn, 2017; Olsson et al., 2013; Zhu & Fan, 2018). Participants in Flynn's (2017) qualitative study reported that those who carpooled found the commute to be less boring, and active commuting allowed commuters to combine exercise into their commute time. Supporting our argument that commuting can help with role transitions, Flynn's (2017) participants also positively evaluated their time spent commuting as an important means to disconnect and recover between work and home.

Hypotheses 3a and 3b: Unfavorable Subjective Commuting Appraisals and Strain/Wellbeing. The relationship between unfavorable appraisals of one's commute and strain and wellbeing outcomes was reported by a handful of studies in the literature showing partial support for Hypotheses 3a and 3b. For instance, commute-related stress was associated with decreases in commuting safety behaviors (Burch, 2015) and life satisfaction (Lachmann et al., 2017). Additionally, Schaeffer et al. (1988) showed that single drivers had significantly higher levels of anxiety and hostility than carpool commuters. However, Mahudin (2012) reported

unexpected relationships in the opposite direction of our hypothesis; findings suggested that commuting stress had a positive relationship with both life satisfaction and job satisfaction.

Hypotheses 4a and 4b: Favorable Subjective Commuting Appraisals and Strain/Wellbeing. Our hypotheses concerning favorable subjective commuting appraisals (e.g., commute satisfaction) and objective strain outcomes (Hypothesis 4a) and wellbeing outcomes (Hypothesis 4b) were supported. Ma and Ye (2019) found that people who were more satisfied with their commute were less likely to be absent from work. Additionally, employees who were satisfied with their commute reported higher work-family balance satisfaction (Denstadli et al., 2017), lower levels of stress (Haider et al., 2013), and higher commute wellbeing (Smith, 2017). Although we do not explicitly present a hypothesis concerning the relationship between commuting resources and wellbeing, commute control and commute predictability decreases one's stress around the commute itself, as our model suggests (Koslowsky et al., 1996; Morrow, 2010). Finally, Schaeffer et al., (1988) hypothesized that commute control mediates the relationship between high commute impedance and stress; however, it is not clear if an indirect effect was found based on the reporting of this study's results.

Hypotheses 5a and 5b: Indirect Effects of Commuting Demands on Strain/Wellbeing through Unfavorable Subjective Commuting Appraisals. We did not identify any studies that have tested and reported results of mediation hypotheses concerning the relationship between commuting demands and strain and wellbeing via unfavorable subjective appraisals, resulting in the inability to evaluate Hypotheses 5a and 5b. We discuss this gap further in the theoretical implications presented in the Discussion.

Hypotheses 6a and 6b: Indirect Effects of Commuting Demands on Strain/Wellbeing through Favorable Subjective Commuting Appraisals. Very little research

has investigated the indirect relationship between objective commuting demands and strain and wellbeing via favorable subjective appraisals. Due to an insufficient basis in the literature (i.e., as no studies have specifically tested these indirect relationships), we were restricted in our ability to directly consider evidence for Hypotheses 6a and 6b. Indeed, Zhou and colleagues (2017) tested indirect relationships, but they do not mirror the pathways depicted in our model (see Figure 1). Specifically, Zhou et al. (2017) assessed a stressor-self regulation relationship via morning strain and included commuting means efficacy as a moderator. Their findings revealed that commuting means efficacy buffered the negative indirect relationship, supporting the notion that individuals view commute stressors as less threatening when they hold positive beliefs about their commuting means.

Meta-Analysis Results

To compliment and extend our systematic narrative review, we present a more focused meta-analysis to further help consolidate this vast literature and provide a (partial) quantitative assessment of our hypotheses. Due in part to the multidisciplinary nature of this literature and its inherent methodological variability, a subset of studies included in our systematic review qualified for inclusion in our meta-analysis. Although we initially intended a broader meta-analytic review (e.g., including an array of objective commuting demands; see OSM for an accounting of deviations from our pre-registration), we ultimately considered studies that reported relationships between self-reported commuting time and/or subjective commuting appraisals and strain outcomes (i.e., burnout, negative affect, and perceived stress) and wellbeing outcomes (i.e., commute recovery experiences, life satisfaction, positive affect, subjective health, and subjective wellbeing).

We chose to focus on this (relatively narrow) range of relationships for two important reasons: First, the results of our systematic review suggested that there is a remarkable amount of variability in how commuting is operationalized in this literature. By primarily focusing on commuting time, we emphasize a specific form of objective commuting demands, which helps provide clarity to how commuting is understood here. This analysis is complemented by a narrower focus on subjective commuting appraisals to more comprehensively represent the relationships implied in our conceptual model (see Figure 1). Second, along with variability in commute operationalizations, there is a great deal of variability in how the results of primary empirical studies are reported in this literature that limits the types of relationships that are available to be meta-analyzed. Specifically, a challenge of this literature is determining zero-order relationships between commute variables and strain and wellbeing outcomes that are required for meta-analysis (e.g., many studies report only partial relationships, such as regression coefficients representing relationships between commuting variables and strain and wellbeing outcomes, accounting for other covariates; see Rudolph & Jundt, 2017).

In developing our meta-analytic database, we observed a notable degree of dependency among effect sizes that represent these relationships in the literature (i.e., studies reporting more than one zero-order correlation between commuting time and strain outcomes). As such, we adopted the recently-advanced hybrid multilevel/multivariate meta-analytic modeling strategy to properly account for the nesting of effect sizes within samples and within studies (i.e., a “three-level” model) and the (plausible) intercorrelation among such effect sizes (see Pustejovsky & Tipton, 2021) with robust variance estimation (RVE). This approach, broadly speaking, maps onto the tradition of the Hedges-Olkin style of meta-analysis (see Rudolph et al., 2020, for a review). Importantly, this approach to meta-analysis corrects for sampling error but not

measurement error or other sources of artefactual variance (e.g., range restriction). This is largely because the multilevel/multivariate meta-analytic modeling strategy and RVE procedures are not formally implemented in the Schmidt-Hunter approach that is commonly used to account for artefacts beyond measurement error.

To conduct our meta-analysis, all models were specified using the `{metafor}` package (Viechtbauer, 2010) for the R (v.4.0.3) statistical computing environment. Following recent advice in the literature (e.g., Tipton, 2015), robust estimates of standard errors and 95% confidence intervals for meta-analytic effects were computed using the `{clubSandwich}` package (Pustejovsky, 2020). We specified a series of meta-analytic models to address the relationship between commuting time and subjective commuting appraisals, and strain and wellbeing outcomes. First, we considered models with all strain and wellbeing outcomes specified separately as “overall” effects (i.e., collapsing across different operationalizations of strain and wellbeing, respectively). Second, we specified models in which individual strain and wellbeing outcomes were modeled separately (e.g., to isolate the effects of commute time on burnout). Consistent with the adoption of a hybrid multilevel/multivariate meta-analytic modeling strategy, individual effect sizes were weighted as a function of individual variance-covariance matrices based on known variances and (assumed) correlations among dependent effect sizes derived from the same sample. In specifying these variance-covariance matrices of dependent effects, the assumed correlation was $r_{xy} = .50$ among effect sizes derived from the same study. Each model was specified with a restricted maximum likelihood (REML) estimator.

The results of the meta-analysis are summarized in Table 1. Contour-enhanced funnel plots (Peters et al., 2008) for commute time-strain and commute time-wellbeing relationships can

be found in Figure 3, panels “a” and “b,” respectively. All data and R code to reproduce these analyses are available in our OSM.

Objective Commuting Demands (i.e., Commute Time). We find that commuting time was positively and significantly associated (i.e., $p < .05$) with overall strain outcomes ($k = 34$, $n = 22,963$, $\bar{r}_{xy} = .089$, 95% CI = .034; .143), and especially perceived stress ($k = 20$, $n = 9,624$, $\bar{r}_{xy} = .153$, 95% CI = .083; .222). These findings support Hypothesis 1a.

Importantly, we note a remarkable amount of heterogeneity in the estimate of the overall effect of commuting time on strain. Specifically, the total I^2 , which reflects how much of the total variance can be attributed to the total amount of heterogeneity (i.e., the sum of between- and within-study heterogeneity), was substantial: $I^2 = 96.682$. Decomposing between-study (i.e., $\sigma_{2.1}$) and within-study (i.e., $\sigma_{2.2}$) variance components suggests that 64.818% and 27.864% of the variance is explained between- and within-study, respectively (i.e., the remaining 7.318% of the variability can be attributed to sampling variance). Additionally, we computed 80% prediction intervals around the observed overall effect. Prediction intervals answer the question, “What is the plausible range of population parameter values to be expected if a new study were to be conducted?” (Inthout et al., 2016). The resulting prediction interval suggests that a plausible range of values for any given relationship between commuting time and strain outcomes could range from $r_{xy} = -.066$ to .244. A forest plot of these relationships further highlights this heterogeneity (see Figure 4). Beyond strain outcomes, we did not note any statistically significant relationships between commuting time and overall wellbeing, nor any specific wellbeing outcome. Thus, Hypothesis 1b was not supported by the meta-analysis. However, as with strain, we do note a great deal of heterogeneity in this estimate (see Table 1 and Figure 3 panel “b”).

Subjective Commuting Appraisals. Compared to our analysis of commute time, fewer relationships between subjective commuting appraisals can be found in the literature ($k = 3$ strain; $k = 7$ wellbeing), with an exclusive focus on unfavorable commuting appraisals (see Figure 1, Hypotheses 3a and 3b). Given that so few studies are present in the literature, we only report overall relationships with strain and wellbeing and do not differentiate by outcome type. Moreover, we are unable to differentiate favorable from unfavorable subjective commuting appraisals in this analysis. Still, we elaborate these relationships here in service of presenting a comprehensive review (see also Table 1). In summary, we find that subjective commuting appraisals are unrelated to overall strain and wellbeing outcomes. Thus, Hypotheses 3a and 3b were generally not supported by these data. As with relationships noted for objective commute time, we observed a great deal of heterogeneity in these estimates. Complete results of these analyses are available in our OSM.

Exploratory Analyses. Beyond the primary analyses that support tests of our hypotheses, we also conducted two exploratory analyses to address the potential for conditional (i.e., moderated) relationships. Although these analyses were suggested as part of the review process, there are theoretical reasons to consider them as well, which we briefly outline below. Of note, because few studies conceptualized subjective appraisals, we focus here only on commute time relationships for these exploratory analyses. These moderator tests were conducted in a meta-regression framework, adopting the same approaches described above to account for non-independence.

First, we considered commute modality as a moderator of commute time and strain and wellbeing relationships. Research on commuting has pointed to the generally negative implications of more passive forms of commuting, such commuting by car, versus more active

forms of commuting, such as walking to work or commuting by bicycle (e.g., Mattisson et al., 2018; Page & Nilsson, 2017). Unfortunately, few studies in our meta-analysis consider such active forms of commuting. Thus, for this analysis, we differentiate studies based on how commute mode was operationalized (i.e., commuting by car vs. mixed modality vs. “other” vs. non-specified modality). Moderators in meta-analysis are considered at the study-level, meaning that commuting by car in this case means that all study participants commuted by car and mixed modality means study participants used a variety of ways go get to work (e.g., car, public transit, etc.). “Other” modality suggests that all study participants used an approach to commuting besides cars (e.g., all participants walked to work, all participants rode a bicycle to work). Finally, several studies failed to report information about the modality of commuting and are represented as “non-specified modality.” In summary, we find that commuting modality did not differentiate the strength of any relationship between commute time and strain or wellbeing outcomes. For example, although we noted that commuting by car was associated with higher levels of strain ($\bar{r}_{xy} = .181$, 95% CI = .001; .361), this relationship was not significantly different from any other observed commute time – strain relationship for any other commuting modality; the same conclusion was drawn regarding commuting modality as a moderator of commute time – wellbeing relationships. Complete results of this analysis can be found in our OSM.

Second, we considered the possibility that commute time itself moderates the relationship between commute time and strain and wellbeing. Such models approximate non-linear relationships (Sturman, 2003) and are informative of the potential for there to be a curvilinear association between time spent commuting and strain and wellbeing outcomes (e.g., suggesting an optimal time for commuting that maximizes its benefits to wellbeing). Indeed, theorizing about work behavior in other domains has posited the presence of such inverted U-shaped

relationships, suggesting the idea of “too much of a good thing” phenomena (e.g., Pierce & Aguinis, 2013). In summary, in both models, commute time was not a significant moderator of either strain or wellbeing relationships. Complete results and an extended explanation for the interpretation of this analysis and its parameters can be found in our OSM.

Sensitivity Analysis. Given concerns regarding omitted studies, we conducted a formal test of funnel plot asymmetry following the suggestions of Rodgers and Pustejovsky (2021). Although multiple means exist for assessing and correcting for the presence of omitted studies, not all are well-gearred for the multilevel/multivariate meta-analytic approach we adopt here. However, Rodgers and Pustejovsky (2021) present a robust variant on Egger et al.’s (1997) regression test (i.e., the “Egger-sandwich” procedure), which uses the RVE approach we adopt in our primary analysis. Briefly, this procedure involves a meta-regression model in which effect sizes are regressed onto an estimate of study precision derived from study sample size. If the slope representing this precision estimate is found to be statistically significant, then there is evidence to suggest that the funnel plot deviates from symmetry. Observed deviations from symmetry can be (cautiously) interpreted as evidence for “missing” studies, which could be due to a variety of factors, including selective selection of effect sizes into a literature (i.e., “publication bias”). Of note, given that this test is a “high-k” procedure, we only consider these tests for commute time models. In summary, we do not find evidence of funnel plot asymmetry for commute time – strain relationships ($b = .387$, $se_b = .360$, 95% CI = - .418; 1.192), or for commute time – wellbeing relationships ($b = .378$, $se_b = .303$, 95% CI = .306; 1.062). Complete results of this analysis are available in our OSM.

Discussion

The goal of this review was to present a holistic view of the implications, both undesirable and desirable, for employees commuting to and from work. To this end, we focused on direct and indirect associations between commuting demands and subjective commuting appraisals and strain and wellbeing outcomes. Due to our theory-based (see Figure 1 for our conceptual model based on the transactional stress model) and systematic approach, this review goes beyond previous narrative reviews to provide the literature with a comprehensive accounting of related studies in this domain. To guide readers, we provide a synthesis of findings in both dynamic tables and an interactive results map that graphically summarizes our findings on our supplementary website. Using these two tools, readers can engage in searches for specific relationships (e.g., commute stress and mental health), variables (e.g., perceptions of time urgency), archival databases (e.g., British Household Panel Survey), study designs (e.g., daily diary studies), analytics approaches (e.g., structural equation modeling), or sample characteristics (e.g., rail transit commuters). In the following, we summarize the general findings of our systematic review and meta-analysis. Then, we broadly discuss theoretical, empirical, and practical implications, followed by limitations of this work and implications for future empirical research (see also Table 2 & Table 3).

Divergence Between Systematic Review and Meta-Analytic Findings

Overall, our hypotheses concerning the commuting experience based on our conceptual model (see Figure 1) were partially supported, but the extent to which this is so depends to some degree on the source of evidence considered. Indeed, our systematic review found support for Hypotheses 1a and 1b, such that commuting demands were positively related to strain outcomes (e.g., blood pressure, job strain, psychological distress) and negatively related to wellbeing outcomes (e.g., life satisfaction, job satisfaction, subjective wellbeing). Likewise, a handful of

studies support that commuting demands are positively associated with unfavorable (Hypothesis 2a) and negatively associated with favorable (Hypothesis 2b) subjective commuting appraisals.

Our systematic review also suggests that unfavorable subjective commuting appraisals (e.g., commute stress) had positive relationships with strain outcomes and negative relationships with wellbeing outcomes, providing support for Hypotheses 3a and 3b. Several studies also supported Hypotheses 4a and 4b, suggesting that favorable subjective commuting appraisals (e.g., commute satisfaction) were negatively associated with strain outcomes and positively associated with wellbeing outcomes. Importantly, although no study has fully tested our conceptual model based on the transactional stress model, support for Hypotheses 3a/3b and 4a/4b represents an important “hint” at the potential countervailing negative and positive influences of commuting demands on decreasing strain and increasing wellbeing that are implied by our model. As such, a closer consideration of the demands-appraisals-outcomes linkage implied by our model should be the focus of future research, as we will discuss below.

It is worth noting that our extensive systematic review of the literature found several studies that either extended beyond our original hypotheses or contradicted the predicted direction of commuting relationships. For instance, only a handful of studies analyzed the relationship between objective commuting demands and their *positive* associations with wellbeing outcomes (e.g., strengthened social networks, job performance), contradicting Hypothesis 1b. Moreover, although some studies included zero-order correlations between multiple subjective appraisals (e.g., commute stress and commute satisfaction), multiple commuting demands (e.g., commute time and commute predictability) or moderation analyses (e.g., commute efficacy buffers the commute stress-commute strain relationship), there were no studies that implemented a mediation analysis to consider the indirect effects implied by our

proposed model (see Figure 1; Hypotheses 5a, 5b, 6a, and 6b). Although we could have created a framework that reflected all these relationships, we believe this would have resulted in a proliferation of possibilities and contributed to the already high level of heterogeneity of the literature. Therefore, we felt it was more appropriate to provide a clear and theoretically driven model to guide future research.

Interestingly, our meta-analytic findings are more ambiguous regarding support for our hypotheses. Specifically, we found a small, positive relationship between commute time and strain outcomes (Hypothesis 1a), but a null relationship with wellbeing outcomes (Hypothesis 1b). Likewise, we find null relationships between unfavorable subjective commuting appraisals and strain and wellbeing outcomes (Hypotheses 3a and 3b), although we note that there was substantial variability in effect sizes for both sets of hypotheses. Given the scope of the literature at this time, we were unable to address other hypotheses implied by our model, and the (relatively) small proportion of studies considered in our systematic review that also qualified for inclusion in our meta-analysis could also have contributed to the ambiguity in our findings. Indeed, we note that a relatively small amount of research has focused on subjective commuting appraisals, making conclusions here tenuous. This suggests the need for more primary research to focus on such relationships, especially on distinguishing unfavorable from favorable subjective commuting appraisals. Additionally, our exploratory analyses suggest that commute mode does not moderate the strength of commute time and strain and wellbeing relationships. Likewise, we find no evidence for non-linear relationships between commute time and strain and wellbeing. However, some apparent funnel plot asymmetry may point to publication bias influencing these results, although it is important to point out that our formal analysis did not detect this to be the case here.

Theoretical and Practical Implications

The results presented here have both theoretical and practical implications. Regarding theoretical implications, our results should be particularly useful for future research to consider (a) theoretically-derived mechanisms and boundary conditions of effects of commuting demands on employee strain and wellbeing, and (b) the implications of commuting for work/non-work experiences, broadly defined. Regarding practical implications, our results should be useful in helping practitioners develop evidence-based approaches to helping employees better manage the demands of their commutes.

Theoretical Mechanisms and Boundary Conditions. Although implied by the transactional stress model and our conceptual model (see Figure 1), coping resources have been scantily considered (as main effects or moderators) in this literature. For example, an employee who actively uses their commute as time to decompress from the workday (or time to mentally prepare for the workday) may find respite during their commute, taking an emotion-focused coping approach. Taking a deeper look into what occurs during the commute, in terms of coping, could help elucidate the difference between a negative commute experience and a positive one.

Additionally, more research focusing on subjective commuting appraisals is needed, especially research that differentiates and investigates differences between favorable and unfavorable subjective appraisals. As subjective commuting appraisals are aspects of the commute that are perceived and psychologically evaluated by the employee, it will be useful to determine how subjective commuting appraisals align with primary and secondary stress appraisals. To this end, there is a need for research that considers the (assumed) causal relationship between commuting demands and favorable and unfavorable subjective commuting appraisals (i.e., primary appraisals), as well as research that allows for the (relative) influence of

commuting demands and subjective commuting appraisals for explaining variation in strain and wellbeing outcomes to be ascertained (i.e., secondary appraisals, for example, whether the employee feels they can cope with the demands of commuting or perceived stressors; see Figure 1). There are several variables that we outline in our framework that we suggest future studies analyze to avoid the heterogeneity in the current literature, such as commute resources (e.g., commute control, commute environment), coping strategies (e.g., recovery behaviors), and favorable commute appraisals (e.g., commute satisfaction). Doing so would allow for stronger tests of our conceptual framework to be performed and inform a more comprehensive meta-analytic investigation of these relationships in the future. Still, the results presented here are an important starting point for such investigations.

Aside from commute resources and subjective appraisals, there are other moderator and mediator variables that could be used in research questions that have not been consistently presented in the current literature. For example, it may be important to consider how the impact of commuting demands varies across demographic characteristics and within their intersections, such as gender, age, and occupations. Regarding gender and age, there are differential relationships between commuting and strain and wellbeing for men and women (e.g., commute time is more strongly related to decreases in wellbeing for women; Jacob et al., 2019) and employees of different ages (e.g., as driving capabilities tend to decline with advancing age; see Dickerson et al., 2019). Regarding intersections of age and occupations, a meta-analysis found that, overall, younger and older workers experienced more work stress (i.e., cognitive irritation) than middle-aged workers (i.e., suggesting a curvilinear relationship between age and work stress), and that older construction or factory workers, for example, experienced more work stress than other age/occupational groups (Rauschenbach et al., 2011). Determining whether

older workers, or workers of varying occupations, engage in different primary appraisals (e.g., that commuting is or is not stressful) and/or secondary appraisals or different means of coping with their commute (e.g., problem-focused coping, emotion-focused coping), ultimately impacting their wellbeing, could be a useful future direction.

Considering the transactional stress model and our framework, research should likewise consider moderator and mediator variables, such as time urgency, to understand the conditional effects of commute variables on strain and wellbeing outcomes. We are currently seeing shifts in the world of work, including emphases on virtual learning, adaptability, and flexible work arrangements (Stark, 2021), and as work and employees become more reliant on technology, understanding the role commuting plays regarding strain and wellbeing outcomes may outline the costs and benefits of *not* commuting. Future research could explore whether commuting has an influence on one's choice to work flexibly or remotely. It seems reasonable that individuals with longer or more stressful commutes may choose to adopt working arrangements that allow them to avoid commuting.

Implications for Work-Nonwork Frameworks. As we have noted, there is an overwhelming focus on the negative implications of commuting, and one potential future direction is to consider commuting as a buffer between the negative effects of work events and experiences on personal life. Studies have explored how commuting relates to family-interference with work (Zhou et al., 2017), work-family balance satisfaction (Denstadli et al., 2017), and work-family conflict in general (Novaco et al., 1991), where both positive *and* negative outcomes abound. One specific way that “commuting as a buffer” could function is through the transition between work and personal roles, domains, and identities, and the commute could be appraised by the employee as a low-stakes event, including one that can

bolster their well-being. According to boundary theory, individuals who prefer to segment work and their personal lives associate transitions between roles with rituals or “rites of passage” (Ashforth et al., 2000, p. 479). Commuting can be one such ritual that facilitates the (daily) psychological and physical boundary transition, where the individual signifies their transition from one role to the next (i.e., from work to home). To this end, Jachimowicz et al. (2021) found that commuting could be proactively used to clarify roles, thereby decreasing the negative impact of a long commute on job satisfaction. In terms of the transactional stress model, which our review is grounded in, reappraising one’s commute in a positive light, including as a time set aside to transition between work and nonwork roles, to prepare for work, or to recover after work, rather than as a hindrance may increase these positive outcomes of commuting.

The work-family, stress and recovery, and telecommuting literatures have only begun to consider commuting’s relationship with variables of interest in their respected areas (e.g., role interdependence, Krausz & Hermann, 1991; technology, Lachmann et al., 2017; family-to-work interference and regulation, Zhou et al., 2017). We suggest that future research continue to investigate the role that commuting has in employees’ navigation of their work and family domains. In addition, although some research has found that recovery experiences attenuate the negative impact of job demands on work-life conflict (Ingels, 2018), this is only supported for employees in a higher socioeconomic class. Therefore, current implications and suggestions may only benefit more privileged commuters (e.g., those who commute via private transit, such as their own cars). Based on the transactional stress model, future research could focus on secondary stress appraisals (e.g., considerations of available resources to cope with commuting demands) and the actual use of coping strategies as potential buffers (i.e., moderators; see Figure 1) for unfavorable commuting appraisals on strain and wellbeing outcomes. We suggest that

organizational science takes initiative in investigating factors that can help underrepresented groups experience positive outcomes from commuting.

Practical Implications. We see several implications for practice stemming from this work. For example, our comprehensive results map, available on our supplementary website, should be of value to practitioners who are interested in developing evidence-based approaches to helping employees with their commutes. By integrating current knowledge regarding commuting, this work informs workplace practices and interventions, particularly those reducing strain and supporting wellbeing. Indeed, since March of 2020, the COVID-19 pandemic has affected organizational leaderships' decision-making surrounding their employees' physical presence being required in the workplace. According to Willis Towers Watson (2020), nearly half of businesses in the U.S. have implemented telecommuting policies since the beginning of 2020. Further, recent research has reported that employees anticipate additional distress about commuting to work again (e.g., Uehara et al., 2021). Our findings have implications for future thinking about the changing nature of work. For example, we need to note the importance of commuting considering new technologies (e.g., driverless vehicle technology) and the makeup of the workforce (e.g., commuting for older workers). Furthermore, the state of the world and frequency of commuting is likely to change in the coming years. Across the globe, commuting times and distances appeared to be increasing (e.g., Wade, 2019); however, the COVID-19 pandemic and telecommuting opportunities may have changed that. As employees increasingly return to working in physical office spaces and resume their commutes, organizations should put effort into understanding the effects commuting will have on their employees. By this, we mean both the possible negative *and* positive implications for commuting.

In our systematic review, commute mode was often conceptualized as a moderator, and the influence of commute mode can either strengthen or mitigate the stressor-strain relationships. For example, public transportation was related to worse outcomes than commuting by car (e.g., Mattisson et al., 2018; Page & Nilsson, 2017), whereas commuting by bike or other active commuting were most beneficial (e.g., Humphreys et al., 2013). However, for portions of the world including impoverished and lower socio-economic status workers, public transportation may be the only viable way to commute, making private or active commuting unfeasible. Like much of the research in the organizational sciences, our review tended to focus on outcomes pertinent to employees in industrialized countries. Thus, it is not only important for practitioners to find ways that employees can reap the benefits of commuting, especially for those who have options for safe, effective commuting, but also find ways to mitigate some of the consequences of commuting for those employees who can only commute via public transportation.

Limitations and Future Research

Despite the growth of literature on commuting since Koslowsky et al. (1995)'s pioneering work, there are methodological problems and incompatible conceptualizations that must be addressed. At the time, Koslowsky et al. (1995) reported there were too many unique conditions and too few studies to perform a meta-analysis on commuting; however, there was hope that large-scale efforts (e.g., Novaco et al., 1979, 1990) would allow for aggregate analyses (i.e., meta-analysis) soon thereafter. Despite the plethora of empirical research investigating the commuting stressor-strain linkage since then, we discovered that the heterogeneity problem persists. Our review was able to systematically summarize several relationships presented within Koslowsky et al.'s (1995) theoretical model (e.g., objective demands, such as traffic characteristics, influence subjective appraisals, such as commute dissatisfaction; Higgins et al.,

2018), but we were only able to broadly summarize a few relationships meta-analytically (e.g., commute time and strain, commute time and wellbeing). Future research must attempt to consolidate these varied efforts, such as coming to a consensus on how to operationalize various aspects of the commuting experience (e.g., commute time, traffic characteristics).

Furthermore, although our review was primarily guided by transactional stress theory, our efforts also illuminate the understudied linkages within Koslowsky et al.'s (1995) theoretical model. Both models outline relationships between demands and appraisals and suggest that commuting experiences can be moderated by a variety of factors. For example, and just as we found with our conceptual model based on transactional stress theory, we were unable to comprehensively address conditional relationships meta-analytically (e.g., considering gender, personality, or commute predictability as moderators). Regarding our focus on commute mode as a moderator in our meta-analysis, the lack of support observed for a conditional effect here may be due to the relative heterogeneity of commuting modalities present across empirical studies, manifest in the observation that modality was often not differentiated within study. Given what we know after reviewing the entirety of the relationships present within the literature, we urge future research to strengthen our understanding of each stage of the commuting experience and its impact on employees by investigating untapped linkages, whether guided by Koslowsky et al.'s (1995) model or the one we present here.

As we have highlighted throughout our review, one consistent feature of the commuting literature is the general notion that commuting will result in negative, strain-related experiences. However, this finding may be due to the emphasis on the negative effects of commuting in the literature, as few studies explored positive implications of commuting. Most included studies were grounded in the argument that longer commutes are associated with undesirable outcomes,

and although this claim appears logical, we found that its support was far from unequivocal. In fact, 62% of all reported relationships included commute time or commute distance as a predictor of a strain outcome, but one-third of those hypothesized relationships were found to be non-significant.

This general pattern of results was likewise evident in our meta-analysis, wherein there was a great deal of heterogeneity to be seen in the overall estimate of the commuting time-strain relationship. It was also surprisingly difficult to make strong generalizations about relationships, especially for meta-analytic reporting, due to the breadth of dependent variables (i.e., 89 in total) and variability in methods. For example, studies that modeled similar criteria would not consistently operationalize the variable with the same measures (e.g., wellbeing, Emre & De Spiegeleare, 2019; emotional wellbeing, Gan et al., 2018; subjective wellbeing, Kroesen, 2014). Operationalizations of commuting predictors also introduced wide variability in reporting of results (e.g., time spent commuting as categorical vs. continuous). Beyond operationalization of variables, subgroup analyses that were at times very specific (e.g., those who commute over 43.33 hours a month for a sample of pilots, Kleinfehn, 2016; women who travel at least 60 kilometers to work, Sandow et al., 2014) and contributed to difficulty in making comparisons across studies.

This problem is even more pervasive when attempting to synthesize reports on outcomes with positive valences. Only 12 out of the 109 studies included in the systematic review investigated the positive influence of commuting on employees. This fraction of findings predominantly focuses on comparisons of various commute modes and reports resultant multiple group comparisons (e.g., biking to work vs. driving, Crane et al., 2015). Research questions concerning the positive impact of commuting are scarce and therefore implications are limited.

Notably, too, we observed an apparent degree of funnel plot asymmetry for these relationships. Considering this and Figure 3, the funnel plot appears to be “shifted” towards favoring positive statistically significant correlations between commuting time and wellbeing (e.g., consider the large “gap” in lower precision, negative relationships). This observation may suggest the presence of publication bias in the estimate of this effect; however, importantly, our analysis suggests that this may not be the case here. This review highlights that the literature across disciplines is vast; however, consolidating replicated relationships with similar variable conceptualizations results in a very small pool of studies. Overall, our findings indicate that commuting often negatively impacts employees, but it appears this conclusion may not be that straightforward.

As such, we conclude here by offering some potential reasons for this ambiguity and outline directions for future empirical research to further unpack the complexities of these relationships. Indeed, after reviewing the literature and summarizing the methodological challenges we encountered during our review, we see several actionable items to address in future studies (see Table 2). For example, future studies should implement more streamlined reporting of quantitative (e.g., zero-order correlations) and qualitative results to support future attempts at aggregating (i.e., through meta-analysis and systematic reviews) findings regarding the influence of commuting. Similarly, a streamlining of the operationalization of commuting-related variables would further support aggregation efforts by ensuring the content domain is accurately depicted by the construct being evaluated.

Future commuting research should also consider expanding beyond quantitative, archival panel-based research and employ qualitative or mixed methods to enhance the richness of their data. Furthermore, conducting new primary data collections would let scholars broaden their

research questions to capture the untapped linkages in the commute experience (i.e., mechanisms of commuting demands, coping strategies and their antecedent commuting resources). From our review, samples have been largely restricted to (archival) panel data (i.e., approximately one third of included studies used varying waves of the same handful of databases for their analyses). To bolster the implications of the commuting literature, we need to first reconsider “what” is important to quantitatively capture when designing studies to investigate commuting-related phenomena. Thus, an increase in the number of studies with a qualitative component ($k = 10$ from the present review) would allow for a deeper understanding of commute-related experiences, especially considering the variability in findings and relevant moderators. Primary data collections, both qualitative and quantitative, would provide insight beyond these studies using panel data, and primary quantitative studies would allow researchers to dictate the operationalization of their variables and include more complex models, study designs, and study analytics. For example, it would be beneficial to utilize available technology to quantify objective commute stressors (e.g., GPS mapping tools; traffic volume data; car dashboard cameras) to overcome heterogeneity in self-perceived time reports.

Moreover, our comprehensive online resources available on our supplementary website should serve to guide future researchers who are interested in these important topics. Our dynamic table and results map may be helpful resources for identifying “gaps” in the literature, including areas in need of future empirical elaboration. Altogether, our systematic review and meta-analysis met our aims to bridge gaps between disciplines, address competing and nonsignificant results present in the commuting literature, direct a shared research agenda, guide future theoretical development, and inform evidence-based practical implications.

Conclusion

Research on commuting to and from work is multidisciplinary, extensive, and relevant, which has led to an abundant yet heterogeneous catalog of studies on this topic. Overall, we can generalize certain findings from this literature and suggest that commuting demands are a common stressor that are associated with increased strain and decreased wellbeing. However, there is emerging evidence that implies that commuting may also result in more favorable outcomes, such as increased wellbeing. Our findings suggest that there is much work to be done to better understand commuting and its implications (both negative *and* positive), and our review creates a foundation for future research and practice. Future research should more carefully attend to the conceptualization and operationalization of commuting variables, tied to theoretical models such as we present here, to allow for more consistent conclusions and ultimately a clearer synthesis of results. Organizations should assess how commuting impacts their employees and consider providing resources to either attenuate negative or strengthen its positive effects.

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Table 1.*Results of Meta-Analysis*

Commute Time	k_{es}	n	\bar{r}_{xy}	se_{robust}	95% CI	80% PI	$\sigma_{2.1} / I^2_{btwn.}$	$\sigma_{2.2} / I^2_{wtn.}$	$I^2_{tot.}$
Overall Strain	34	22,963	.089	.026	[.035; .143]	[-.066; .244]	0.009 / 64.818% *	0.004 / 27.864% *	92.682%
Burnout	3	1,162	.016	.068	[-.275; .307]	[-.218; .250]			
Negative Affect	12	12,177	.032	.033	[-.041; .106]	[-.102; .167]			
Perceived Stress	20	9,624	.153	.031	[.083; .222]	[.019; .287]			
Overall Wellbeing	166	72,662	.004	.014	[-.025; .034]	[-.095; .104]	0.004 / 64.292% *	0.002 / 27.717% *	91.109%
Life Satisfaction	29	4,611	.005	.013	[-.024; .035]	[-.088; .099]			
Positive Affect	17	3,478	.002	.014	[-.028; .033]	[-.056; .061]			
Subjective Health	55	60,359	.004	.015	[-.028; .036]	[-.089; .098]			
Subjective Wellbeing	65	4,214	-.012	.009	[-.036; .013]	[-.056; .042]			
Commute Stress Appraisals	k_{es}	n	\bar{r}_{xy}	se_{robust}	95% CI	80% PI	$\sigma_{2.1} / I^2_{btwn.}$	$\sigma_{2.2} / I^2_{wtn.}$	$I^2_{tot.}$
Overall Strain	3	728	.328	.238	[-.696; 1.35]	[-.325; .824]	.084 / 49.272%	.084 / 49.272%	98.545%
Overall Wellbeing	7	1,393	.079	0.107	[-.256; .413]	[-.245; .405]	.039 / 87.341% *	.003 / 7.671% *	95.011%

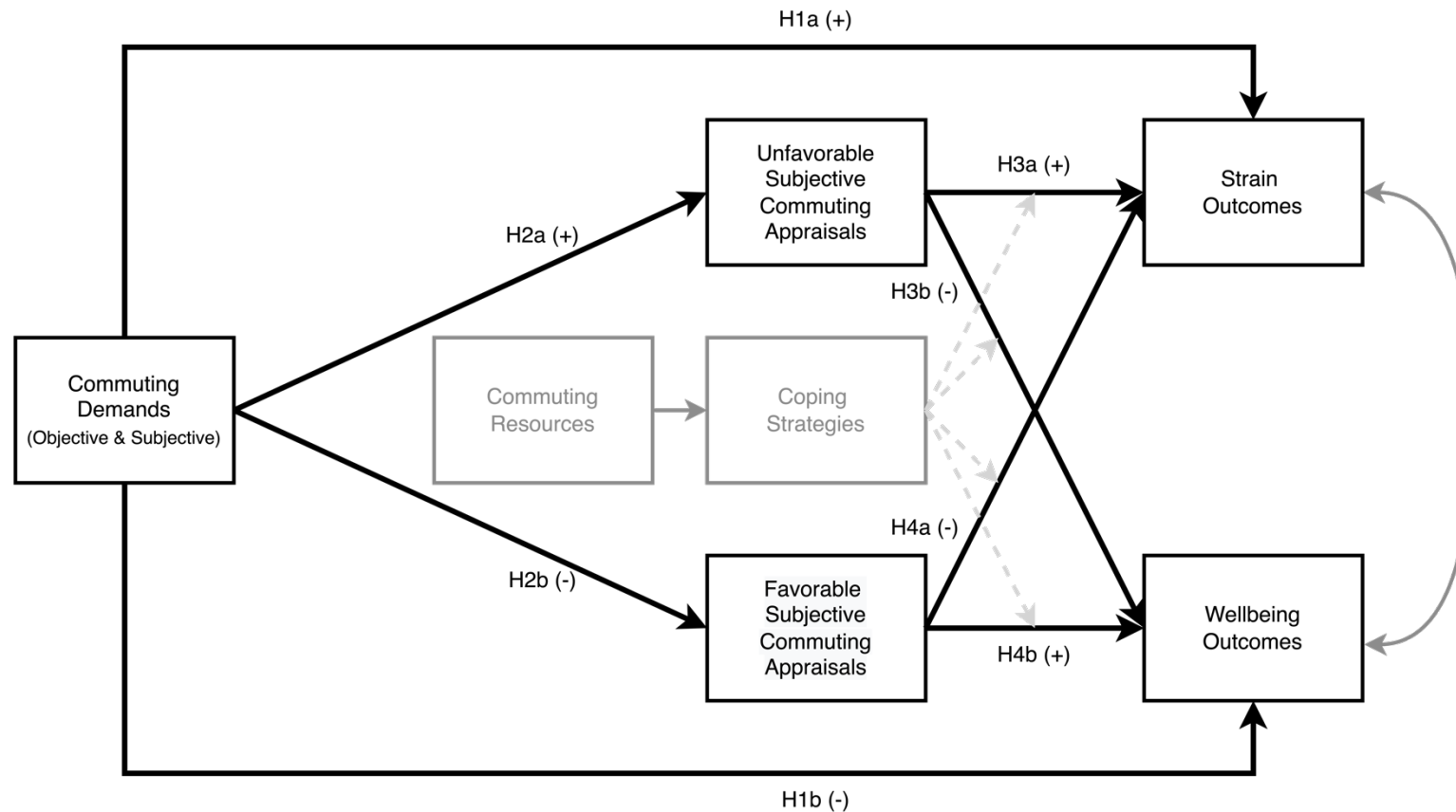
Note. Commuting Demands = objective commuting demands (i.e., commute time); Commuting Appraisals = subjective commuting appraisals; k_{es} = number of effect sizes (i.e., based on $k = 39$ studies), n = approximate sample size, \bar{r}_{xy} = meta-analytic effect size estimate, se_{robust} = robust standard error for \bar{r}_{xy} , CI = confidence interval, PI = prediction interval, $\sigma_{2.1} / I^2_{btwn.}$ = within-study variance components, $\sigma_{2.2} / I^2_{btwn.}$ = between-study variance components. $I^2_{tot.}$ = estimate of variance that can be attributed to the total amount of heterogeneity (i.e., the sum of between- and within-cluster heterogeneity). Given the nested nature of the data, sample sizes are approximate. * $p < .05$.

Table 2.*Actionable Items to Address Methodological Challenges*

Methodological Challenge	Implication	Actionable Items
Heterogeneity of research methods	Diversity of methods can limit future efforts to aggregate research findings	<ul style="list-style-type: none"> ▪ Use more streamlined methods (e.g., consistent reporting of zero-order correlations) ▪ Utilize qualitative aggregation methods (e.g., systematic reviews)
Overwhelming focus on negative effects of commuting	Overlooks possible positive linkages, such as relationships with recovery or benefits of transitioning from work-to-home or home-to-work	<ul style="list-style-type: none"> ▪ Consider positive and negative outcomes of commuting, including factors that could attenuate relationships
Breadth of criteria studied	Examining over 80 different criteria makes it challenging to make generalizable statements about commuting outcomes	<ul style="list-style-type: none"> ▪ Consistency in operationalization of variables
Use of quantitative, panel-based research	Lacks the richness of qualitative data	<ul style="list-style-type: none"> ▪ Employ more qualitative methods or add qualitative components to quantitative methods ▪ Conduct primary data collections

Table 3.*Summary of Implications from Findings*

Implications for Theory
<ul style="list-style-type: none">▪ Advancement in work-family/work-nonwork theoretical frameworks to understand the role of commuting in boundary management.▪ Expand our understanding of subjective appraisals and recovery experiences surrounding commuting to various commute modes and low socioeconomic status commuters.
Implications for Future Empirical Research
<ul style="list-style-type: none">▪ Utilize technology for collecting data on objective commuting demands to overcome heterogeneity in self-reported commuting demands▪ Implement qualitative study designs and primary data collections.
Implications for Practice
<ul style="list-style-type: none">▪ Assess the impact of commuting-related demands for employees returning to the office after working remotely.▪ Offer resources that mitigate some of the consequences of commuting for those workers who can only commute via public transportation.

Figure 1.*Conceptual Framework*

Note. Dashed lines represent relations that are (assumed to be) modified (i.e., moderated) by coping strategies. Indirect/mediated effects (i.e., H5a,b and H6a,b) are implied by combining "a" and "b" path relations. Grey-shaded boxes & arrows represent variables and parameters that are implied by the model but are not formally considered here.

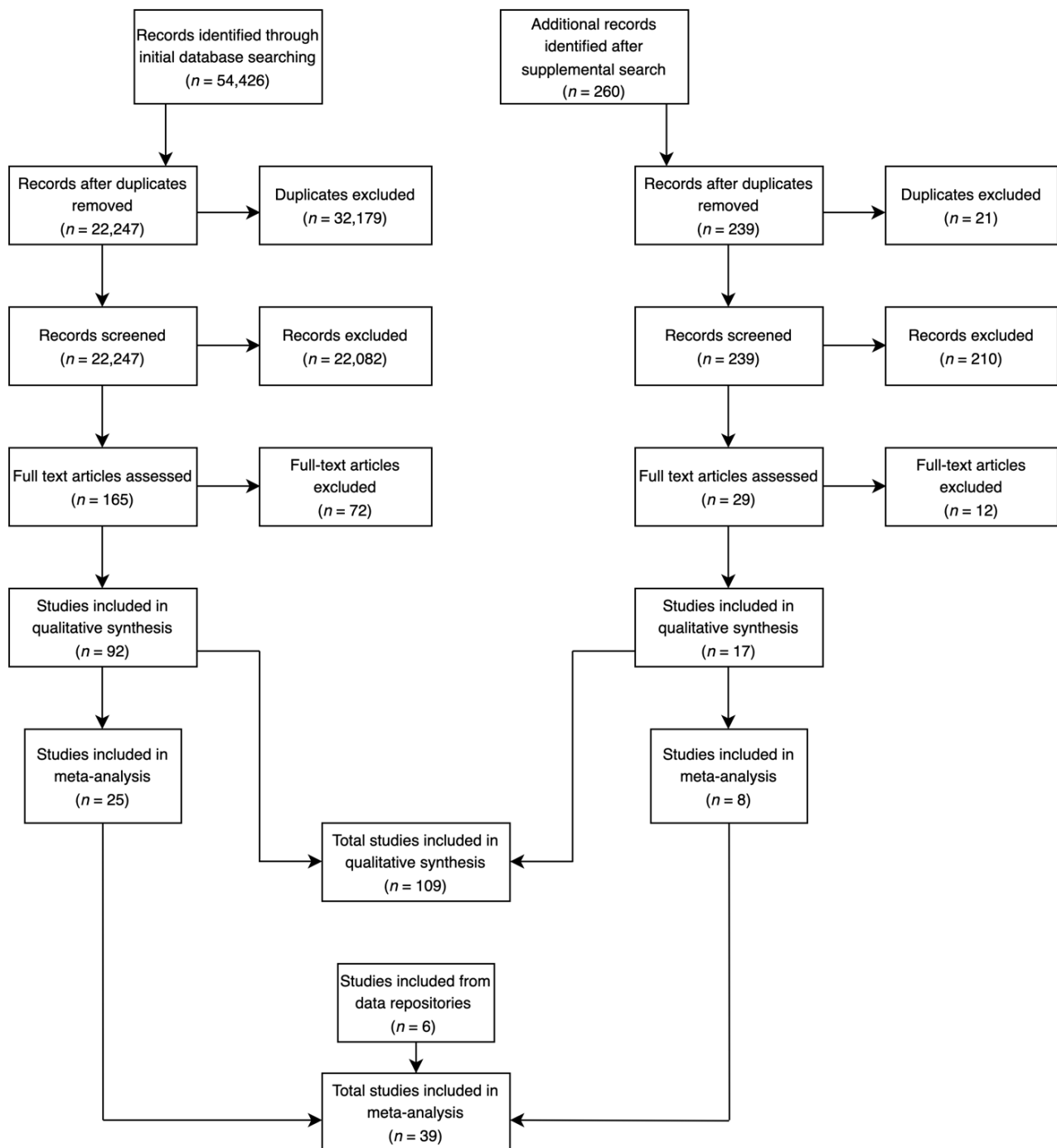
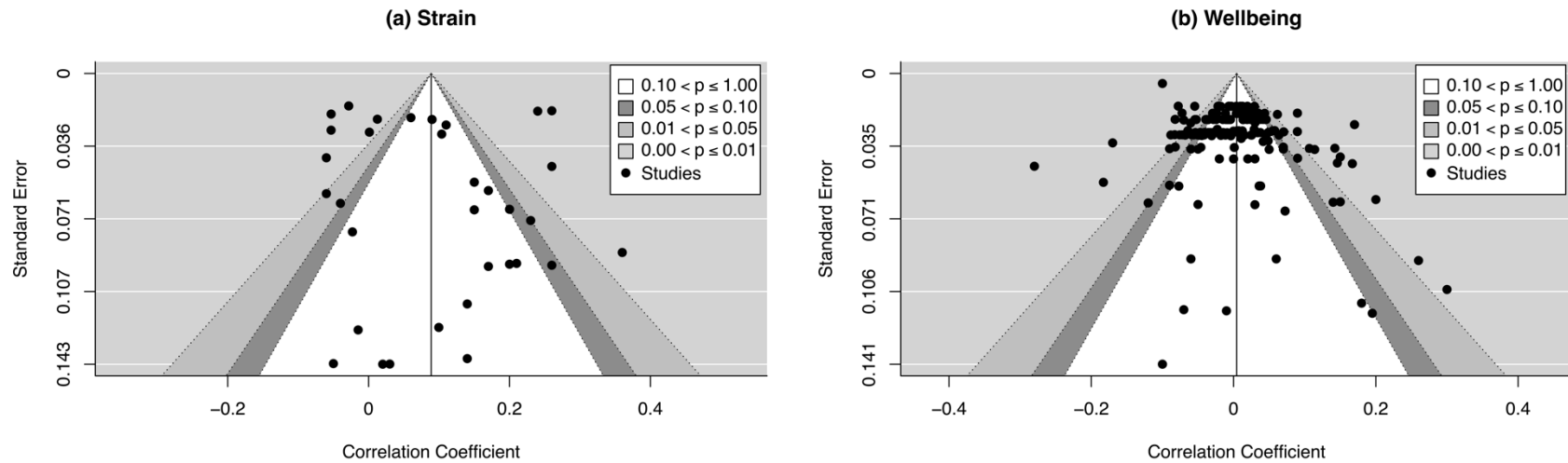
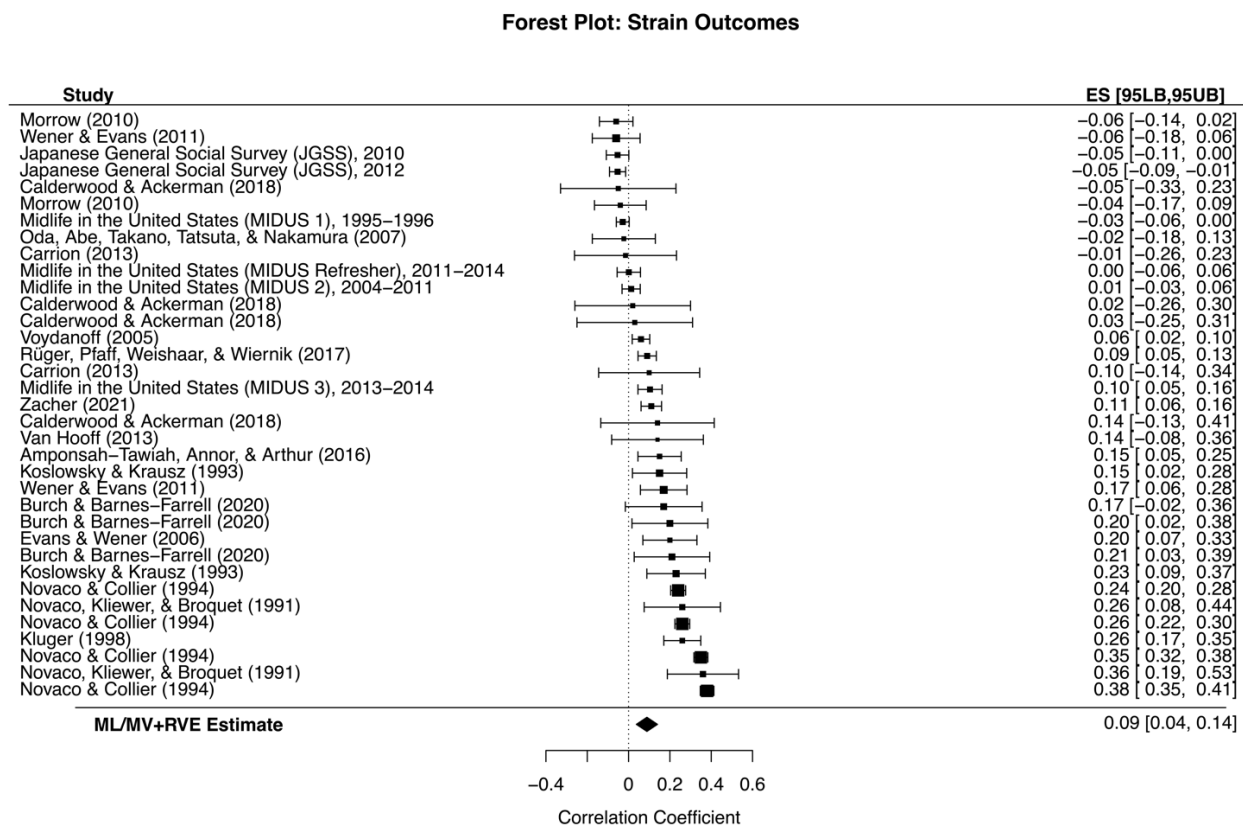
Figure 2.*PRISMA-style Flowchart of Screening Process*

Figure 3.

Contour Enhanced Funnel Plots for Commute Time – Strain (a) and Commute Time – Wellbeing (b) Relationships



Note. Funnel plot centered on meta-analytic estimate. Grey-shaded regions represent boundaries for the statistical significance of observed effect sizes (see figure legend).

Figure 4.*Forest Plot for Commute Time – Strain Relationships*

Note. ES = effect size; 95LB/95UB = lower and upper boundaries of 95% confidence interval. Individual squares represent effect sizes (i.e., zero-order correlations representing effect size estimates, sorted in ascending order of magnitude) between commute time and strain variables. The size of each the square represents the (inverse variance) weight assigned to each effect size in the overall meta-analytic model. Whiskers around each square represent 95% confidence intervals for each effect. The location of the diamond represents the magnitude of the overall meta-analytic estimate, whereas the width of the diamond represents the 95% confidence interval for this estimate.

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