Environmental Impacts on Psychological Well-Being for Individuals Experiencing Homelessness

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According to the U.S. Department of Housing and Urban Development, over half a million people in the United States experience homelessness on any given night (Henry et al., 2018). Estimates suggest that up to 150 million people experience homelessness worldwide, a number which amounts to roughly two percent of the world's population (Chamie, 2017). People experiencing homelessness face a wide range of adverse circumstances, among which are environmental stressors.

Environmental stressors are specific conditions that occur in the world surrounding a person (or other organism) which pose a threat to health and well-being (Baum, Singer, & Baum, 1982, p. 15). An individual will respond to environmental threats, and the threshold into environmental stress is crossed when an individual is unable to properly respond to these demands (Evans, 1982, p. 1). Stress elicits response, and responses to environmental stressors can be both physiological and psychological (Evans, 1982, p. 3).

The study of environmental stress and response is grounded in the field of human-environment studies, which has also been referred to as environmental psychology or people-environment studies. This tradition of research focuses on the interaction between the person and their surroundings (Evans, 1982, p. 1). Both aspects of this interaction involve highly complex and diverse systems, and so the field of human-environment studies is necessarily interdisciplinary, involving elements of cognitive and behavioral sciences, biology, environmental sciences, sociology, geography, and architecture (Graumann, 2002, pp. 96-97).

Human-environment studies can be further understood from a standpoint of phenomenological philosophy. This approach provides an argument at the most foundational

level for the study of the person and their surroundings in tandem: the ways in which our physical surroundings affect us depend upon the meanings we apply to them (Graumann, 2002, p. 97). More broadly, phenomenology argues that it is impossible to understand humans apart from their environments and impossible to define environments as separate from humans, since humans are the ones providing meanings to their surroundings (Graumann, 2002, pp. 98-99). Thus, the field of human-environment studies seeks to understand the lived and experienced space (Graumann, 2002, pp. 101-102). Some philosophers have defined this concept with the term *Umwelt*, used to describe a person's immediate physical and social environments and the meanings the person applies to them (Graumann, 2002, p. 100).

This paper will briefly review certain aspects of the lived space for individuals experiencing homelessness. Specifically, the purpose of this review is to understand the multitudinous consequences of environmental stressors on people during a time of homelessness. My anecdotal impression is that the general populace is relatively unaware of the adverse effects of environmental stimuli upon people facing housing insecurity; thus, I hope to outline the ways in which certain specific stressors impact the psychological well-being of these people.

Methods

This paper will synthesize literature from a variety of disciplines to examine the adverse effects of the physical and social environment on the psychological well-being of individuals experiencing homelessness.

The first research section of the paper will outline the major environmental factors which, based on their effects and the situations in which they take effect, may disproportionately impact people with no home to live in. The analyses of past studies on each of these factors will be

compiled in order to demonstrate the psychological consequences of human exposure to these stimuli. The majority of factors considered in this section will be elements of the physical environment, but due to the phenomenological understanding of holistic human-environment interactions outlined above, I find it necessary to understand not only the individual's relationship to their surroundings but also their relationships to other individuals. Thus, the social environment will also be included in this section of the literature review.

The second research section of the paper will outline theories of psychological well-being. The empirically-validated scientific framework this paper will utilize to understand psychological well-being is Self-Determination Theory (SDT), posited by Ryan and Deci (2000). A basic understanding of psychological well-being will be outlined, the focus of the paper will narrow to succinctly summarize SDT, and the components of well-being as hypothesized by SDT will be explained thoroughly.

The synthesis section of the paper will integrate the two major fields of research synopsized in the prior two sections and apply them to address the needs of the homeless population. The psychological consequences of environmental factors will be examined through the lens of SDT's understanding of well-being. The product of these two bodies of literature viewed together will then be used to infer how environmental factors specifically affect the well-being of homeless individuals. Additionally, recommendations will be made for directions in future research which would enable a better communal understanding of the environmental psychology of marginalized communities such as homeless populations.

The final section of the paper will concern ethical philosophy. This section will foster a better understanding of the hardships that marginalized communities such as the homeless population face, so that agencies can be optimally informed in the pursuit of beneficence, justice,

and respect for members of these communities. The ethical philosophy section will draw ideas from Rawls' Theory of Justice and Nussbaum and Sen's Capabilities Approach in order to examine the importance of studying environmental stress for homeless populations.

Research Section I: Characteristics of the Physical and Social Environment

Since this paper's understanding of the word "environment" is the sum total of a human's surroundings, an individual comes into contact with a host of environmental factors even in a single moment. It would be impossible to examine the psychological impacts of these innumerable stimuli with brevity, so this paper will focus on a few characteristics of the physical and social environment which seem particularly relevant to individuals experiencing homelessness. Namely, the scope of this paper will include three physical facets: noise, thermal stress, and air pollution. Additionally, two physical-social facets will be addressed: crowding and neighborhood environments. Rationales for the inclusion of each of these factors in this analysis over other environmental characteristics will be explained in the specific sections devoted to each factor.

Environmental Factor 1: Noise

Noise is generally defined as sound unwanted by the listener (Kryter, 1970, p. 1; Cohen & Weinstein, p. 46). Thus, noise can be a somewhat subjective concept, since the loud music blaring from the apartment upstairs at midnight could be noise to you but desired sound to your neighbor above you. However, certain types of sound are more likely to be widely considered noise, since few people find the loud sounds from highways, airplanes, or construction to be pleasant auditory stimuli. Due to the prevalence of these three and other sources of noise, particularly in urban settings, noise pollution is an extremely pertinent topic of study for those

researching environmental effects on homeless individuals. This holds especially true since over half of homeless individuals live in urban settings (Henry et al., 2018).

Noise is likely to have adverse effects on multiple aspects of human psychology, including performance, social behavior, mental health, and sleep quality. The research on each of these consequences to noise will be summarized in this section.

The impacts of noise on mental health are not yet fully known by researchers, as the literature has returned inconsistent results. For example, a study on ambient neighborhood noise in Austria found that only schoolchildren with biological risk for mental health problems who were exposed to higher levels of ambient highway and railroad noise at home self-reported lower levels of mental health (Lercher, Evans, Meis, & Kofler, 2002). On the other hand, a study of schoolchildren living in areas of high noise around London's Heathrow Airport reported higher levels of annoyance than their low-noise counterparts but did not produce higher levels of cortisol, a biological marker of stress, than the control group (Haines, Stansfeld, Job, Berglund, & Head, 2001). A recent health survey from Beijing found that citizens who self-reported higher noise also tended to self-report higher levels of anxiety, stress, fatigue, headache, and sleep disturbance (Ma, Li, Kwan, & Chai, 2018). However, a study using similar self-report measures to understand the relationship between aircraft noise and mental health in Belfast found that after adjusting for socioeconomic status, noise did not predict self-assessed mental health (Wright, Newell, Maguire, & O'Reilly, 2018).

Evans (2003) argues that environmental factors have both direct and indirect influences on mental health, and it is perhaps the indirect effects of noise on health that are the most well-known. Uncontrollable noise can produce learned helplessness, a cognitive pattern which can lead to depression (Alloy, Peterson, Abramson, & Seligman, 1984; Abramson, Seligman, &

Teasdale, 1978). Additionally, noise can lead to negative mental health and well-being outcomes when mediated by loss of sleep (Muzet, 2007).

Noise pollution from a variety of sources can negatively impact sleep quality and quantity. Input from auditory pathways can still reach the brain during sleep, so the body can still respond to noise while asleep (Muzet, 2007). Exposure to noise greater than 65dB lengthens the time it can take to fall asleep, as does exposure to intermittent noise around 45db (Jakovljevic, Belojevic. Paunovic, & Stojanov, 2006; Muzet, 2007). Additionally, exposure to noise can result in more frequently waking up at night, more difficulty falling back asleep, and waking up in the morning more prematurely (Jakovljevic et al., 2006; Muzet, 2007). The amount of time spent in REM sleep can also be maximized by reducing levels of noise exposure during sleep (Stansfeld & Matheson, 2003). Finally, even if the sleeper remains unconscious of nighttime noise, autonomic responses such as increased blood pressure and higher heart rate may result from noises during sleep (Stansfeld & Matheson, 2003). And while many people habituate to noise during sleep, reducing the ill effects on sleep disturbances over time, these autonomic responses do not taper off after long periods of exposure to nocturnal noise, which may result in long-term stress and health detriments (Stansfeld & Matheson, 2003; Muzet, 2007).

Reduced sleep quantity and quality due to noise result in numerous secondary effects on health and behavior. The morning after a night of exposure to noise, increases in stress hormones such as cortisol can be measured (Muzet, 2007). Daytime fatigue due to lack to sleep can result in negative behavioral change, reduced concentration, a more negative mood, and impaired performance (Stansfeld & Matheson, 2003; Muzet, 2007). Despite all this, it is worth noting that studies examining the relationship between noise and sleep have sometimes been contradictory,

and researchers suggest that future epidemiological studies should robustly examine this question in a field setting (Muzet, 2007).

Inseparable from the effects of noise on sleep are its consequences related to performance. Muzet (2007) suggests that nocturnal noise predicts lower work capacity and a higher rate of accidents at work through the mechanism of sleep disturbance. In addition to being indirectly related through sleep, noise and performance have been shown to be directly related.

Noise that is unpredictable, uncontrollable, and intense depletes attentional resources enough to have negative consequences on task performance (Glass & Singer, 1972, p. 24; Cohen & Weinstein, 1982, p. 48). These effects can occur during or after exposure to noise, and the relationship between noise and performance has been replicated in both laboratory and field settings (Cohen & Weinstein, 1982, pp. 48-54). Cohen, Glass, and Singer (1973) found that schoolchildren whose home environments exposed them to high levels of noise suffered in auditory discrimination and reading tasks when outside of the noisy environment, with children who had lived in the noisy environment longer experiencing greater levels of impairment. Correlational data from multiple studies replicates the inverse predictive relationship between noise and performance in schoolchildren (Cohen & Weinstein, 1982, pp. 52-54).

Finally, noise has consequences on social behavior. Cohen and Weinstein (1982) present a meta-analysis of studies which find that exposure to noise impairs sensitivity to the needs of others and diminishes helping behavior in a variety of situations (pp. 54-56).

Environmental Factor 2: Thermal Stress

The term thermal stress encapsulates a wide range of human responses to extreme temperature conditions. Extreme heat and cold conditions can impact human health, performance, and social behavior (Bell & Greene, 1982, p. 75). Because of the increased

vulnerability of individuals experiencing homelessness to meteorological extremes, the effects of thermal stress are crucial to understand from the perspective of well-being for these individuals (Romaszko, Cymes, Draganska, Kuchta, & Glinska-Lewcuk; 2017).

Cold spells are an immediate crisis for those living without shelter. Romaszko et al. (2017) found that death from hypothermia was thirteen times more common among the homeless population than the general population. On the other hand, extreme heat can have negative consequences on health and increase mortality for populations spending significant amounts of time outside (Laschewski & Jendritzky, 2002; Tawatsupa, Lim, Kjellstrom, Seubsman, Sleigh, & The Thai Cohort Study team, 2010). Heatwaves particularly impact urban populations due to the "heat island effect," in which the landscapes of urban environments absorb more heat (McMichael, Woodruff, & Hales, 2006). Since two-thirds of individuals experiencing homelessness are unsheltered and over 80% reside in urban or suburban areas, the short-term risks of heatwaves to these individuals is particularly high (Henry et al., 2018). People facing mental illness are at higher risk for death in heatwaves (McMichael et al., 2006). The most recent quality data available suggests that over a quarter of the sheltered homeless population faces serious mental illness; if a similar number of unsheltered homeless individuals also struggle with mental illnesses, they are particularly vulnerable (Khadduri, Culhane, Leopold, Rothschild, & Cortes, 2010). Additionally, thermal stress can be detrimental to long-term health outcomes, including measures of psychological distress, which was predicted in one study by self-reported occupational heat stress (Tawatsupa et al., 2010).

The effects of temperature on cognitive performance are mixed and task-dependent. Cognitively, both heat and cold can negatively influence effective cognitive functioning, depending on the task. Bell and Greene (1982) analyze multiple studies suggesting that

immersion in extremely cold environments can impair attention, short-term memory, and general mental capacity (p. 86). On the other hand, mental performance dwindles in the presence of extreme heat (90-110°F) particularly as time exposed to these conditions increases (Hancock & Vasmatzidis, 2003; Lopez-Sanchez, 2018). Unsheltered homeless individuals stand to be particularly impacted by these conditions, since they are often exposed to them for long periods of time.

Finally, thermal stress has demonstrable impacts on social behavior. This relationship has been studied particularly with regards to violent crime and aggression. Generalized data from across the United States have shown a pattern of increased violence and aggression with increased temperatures (Anderson, 2001). This pattern holds no matter the timescale: hot days lead to increased violent behaviors, as do hot seasons and hot years (Anderson, 2001). Aggravated assault rates across the United States rise and fall with the seasons, as do attempted murder rates in Pakistan (Simister & Cooper, 2005; Simister & Van de Vliert, 2005).

The exact nature of the relationship between heat and violence remains somewhat unclear, with some data supporting a linear relationship and others a curvilinear, inverted-U relationship. Data from Dallas demonstrate a curvilinear relationship between daytime temperature and aggravated assault rates, in which violence peaks at moderately high temperatures (e.g. 75º-85ºF) (Rotton & Cohn, 2000). Simister and Cooper (2005), on the other hand, report that extremely hot temperatures predict higher rates of violent behavior in cities across the United States. Results from Pakistan seem to show that murder rates increase linearly with temperature, but that the relationship between temperature and political violence is more curvilinear (Simister & Van de Vliert, 2005). According to Simister and Van de Vliert (2005), the curvilinear relationship may be explained by the presence of rainfall during the hottest

temperatures in Pakistan's monsoon climate. They find that rainfall reduces murder rates but that humidity exacerbates it (Simister & Van de Vliert, 2005).

Another question to consider is the difference in violence by region. The southern U.S. has consistently higher violent crime rates than the rest of the country (Anderson, 2001). Some scholars have argued that the culture of the South can explain this effect, perhaps due to the legacy of slavery. Anderson (2001) presents a latent variable analysis which contradicts this claim, in which temperature had a positive effect on violent crime in U.S. cities whereas "Southernness" had no effect. Similarly, Simister and Cooper (2005) found that aggravated assault rates in the United States decreased with higher latitude, with the notable outlier of Puerto Rico, which had low rates of assault despite its tropical location. This effect may be explained by the higher rainfall totals in Puerto Rico or by human behavioral acclimatization to persistent hot temperatures (Simister & Cooper, 2005; Simister & Van de Vliert, 2005).

A sensible conclusion to these debates about the specific relationship between thermal stress and violence is that both the atmospheric factors related to thermal stress and the psychophysiological antecedents of aggression and violence are exceedingly complex. Thus, the exact nature of the relationship between heat and violent crime may differ by location and time.

A final consideration on the behavioral effects of thermal stress is the mechanism by which heat leads to aggression. Anderson (1989) lays out five theories, including the negative affect escape model. This model suggests that moderate negative affect (e.g. caused by moderately high temperatures) results in aggression, whereas high negative affect (e.g. caused by extremely high temperatures) leads to escape behaviors, reducing aggression. Rotton and Cohn (2000) use this model to support their curvilinear results of violence and daytime temperature. An alternative model, originally posited by Anderson (1989) and expounded upon by Simister

and Cooper (2005), takes a physiological approach rather than a psychological one. This "physiological-thermoregulatory hypothesis" notes that thermal stress causes the production of epinephrine, norepinephrine, and testosterone in the human body. Adrenaline, which is produced during moments of high temperature, particularly has been implicated as a possible endocrinal precursor to aggressive behavior (Simister & Cooper, 2005).

Environmental Factor 3: Air Pollution

While noise pollution and thermal stress have been extensively studied, several other environmental factors with less publicity also impact psychological well-being. Among these stimuli is air pollution. Research on air pollution has largely focused on the multitudinous consequences of particulate matter air pollution on physiological health and morbidity (Pope & Dockery, 2006). Particularly since climate change stands to increase the prevalence of pollutants such as ozone (Nolte et al., 2015), studies which examine the physiological health effects of air pollution on individuals experiencing homelessness should be conducted. However, physiological health effects are largely outside the scope of this paper, so the next section will focus on the psychological and social impacts of air pollution. It is important to consider how air pollution relates to individuals experiencing homelessness because such pollutants have disproportionate consequences on those who spend large amounts of time outside and for those in urban areas (Ramin & Svoboda, 2009; Pope & Dockery, 2006).

Air pollution appears to have somewhat similar effects on social behavior as noise and heat, although research on these effects has been limited. Pollutants which emit a bad odor result in diminished helping behavior and heightened aggression to a certain extent (Evans & Jacobs, 1982, p. 116). Exposure to secondhand smoke from cigarettes increases aggression (Jones &

Bogat, 1978). In addition to unpleasant odors reducing prosocial behavior, pleasant odors can bolster helping behaviors (Gueguen, 2001; James, 2006).

The effects of air pollution on mental health are more extensively researched and more alarming. Numerous studies have implicated air pollutants as a risk factor for increased rates of suicide and attempted suicide. Exposure to ozone increased the suicide rate in Korean locales for up to four weeks after exposure, and exposure to particulate matter increased risk for suicide, particularly for individuals with cardiovascular disease (Kim et al., 2015; Kim et al., 2010). Similarly, a study in Germany found higher levels of ozone on days in which multiple suicides occurred compared to days where fewer than two suicides occurred (Biermann et al., 2009). Data from Taipei demonstrated that a third of variance in suicide rates could be predicted by environmental factors, including exposure to sulfur dioxide and ozone as well as increased temperature (Yang, Tsai, & Huang, 2011). Exposure to ambient carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter predicted suicide attempts in winter and emergency room visits for depression in two Canadian studies (Szyszkowicz, Willey, Grafstein, Rowe, & Colman, 2010; Szyszkowicz, 2007).

One suggested mechanism by which air pollution can lead to higher suicide rates is via toxic neurological impacts of these pollutants (Szyszkowicz, Willey, Grafstein, Rowe, & Colman, 2010). Chronic exposure to urban air pollutants resulted in increased neuropathology similar to Alzheimer's disease in dogs (Calderón-Garcidueñas et al., 2003). In addition to the results of animal studies, a wide variety of adverse effects have been attributed to air pollution in both human adults and children, including reduced cognitive function, neuroinflammation, and susceptibility to neurodevelopmental disorders, stroke, multiple sclerosis, and neurodegenerative

diseases such as Alzheimer's (Genc, Zadeoglulari, Fuss, & Genc, 2012; Calderón-Garcidueñas, Leray, Heydarpour, Torres-Jardón, & Reis, 2016).

Given the high rates of suicidal ideation for individuals experiencing homelessness (Desai, Liu-Mares, Dausey, & Rosenheck, 2003), the role of air pollution in exacerbating neurological damage and predicting suicide attempts is critical to understand in order to assess the psychological needs of this population.

Environmental Factor 4: Crowding

In addition to characteristics of the physical environment that should be addressed to understand psychological well-being in individuals experiencing homelessness, certain characteristics that result from the social environment are germane to the psychological needs of these individuals. One such factor, which particularly relates to the lived experience of individuals with housing instability, is crowding.

Crowding is a subjective psychological experience that relates to the objective characteristic of density, or number of people in a given area (Lawrence, 2002, p. 403). Saegert (1978, p. 260) argues that crowding, like other environmental stressors such as noise, should be examined with regard to its intensity, unpredictability, and uncontrollability. As unpredictable, uncontrollable, and intense noise carries attentional costs (Glass & Singer, 1972, p. 24; Cohen & Weinstein, 1982, p. 48), so does intense, uncontrollable, and unpredictable crowding lead to attentional and social overload (Saegert, 1978, pp. 260-261). Social overload and subjective crowding result from the amount of social interaction one expects to face in a situation (Saegert, 1978, p. 261). Social overload can place additional burdens on individual and cooperative decision-making and can lead to withdrawal (Saegert, 1978, p. 261). Additionally, aggressive

behavior can result as a coping mechanism for people in high-density environments (Kuo & Sullivan, 2001; Regoeczi, 2003).

Crowding can also impact cognitive ability and physiological responses. Close physical proximity to another person and violation of personal space can result in activation of the amygdala (Kennedy, Gläscher, Tyszka, & Adolphs, 2009). According to Worchel & Teddlie (1976), people will then attribute this tense arousal to surrounding individuals. In addition to interpersonal attributions that can lead to aggression or avoidance, the tense arousal resulting from violations of personal space via crowding can lead to constant vigilance and anxiety (Maeng & Tanner, 2013).

Crowded environments also adversely affect mental health. Lepore, Evans, and Palsane (1991) demonstrate increased psychological symptoms longitudinally in chronically crowded environments and theorize that chronic environmental stress exacerbates momentary social stress. The relationship between chronic crowding and psychopathology is mediated by a loss of social support: overgeneralized avoidant behavior to all people due to the tense arousal of high-density living situations can lead to less supportive relationships, which may have deleterious consequences on psychological health (Evans, Palsane, Lepore, & Martin, 1989). Due to the negative effects of crowding on social behavior and mental health, it is an important environmental factor to consider alongside psychological well-being in homeless populations.

Environmental Factor 5: Neighborhood Environments

Crowding is a single characteristic of residential and neighborhood environments, but many physical and social stimuli impact a person's interaction with their neighborhood. The neighborhood environment may be particularly valuable to understand in the context of homelessness, since individuals experiencing homelessness spend more time in outdoor

environments than most people, and since unsheltered individuals in particular have very little access to indoor environments.

Among the most well-studied physical neighborhood characteristics is green space. In a study of public housing residents, people who lived near trees and grass exhibited greater attention, less mental fatigue, and less aggression than those who did not live near nature (Kao & Sullivan, 2001). Additionally, nearby green space is associated with advantageous health outcomes for people in low-SES urban communities, including decreased stress as measured by the hormone cortisol and by self-report (Thompson et al., 2012; Thompson, Aspinall, & Roe, 2014).

In addition to physical neighborhood characteristics such as green space, social neighborhood characteristics play a role in psychological well-being. Popenoe (1973) argues that the neighborhood can serve essential purposes such as primary friendships, social control, and a sense of security. The influence of the neighborhood environment starts early, with numerous physical characteristics of neighborhoods impacting child development (Christian et al., 2015). Additionally, social capital gained from community in neighborhoods can improve health and lower mortality rates in those neighborhoods (Lochner, Kawachi, Brennan, & Buka, 2003). Furthermore, an inverse relationship has been demonstrated between social capital and death rates by psychiatric disorders and suicide (Sundquist et al., 2014). Because of the potential beneficial physical and social characteristics of neighborhood environments, a better understanding of these environments is useful for examining psychological health in the homeless population.

Research Section II: Psychological Well-Being

Positive psychology is a broad and diffuse field which examines positive experiences, traits, and institutions; it was originally formulated to fill in the gaps left by decades of psychological research focused on pathology and mental illness rather than on mental health (Seligman & Csikszentmihalyi, 2000). Numerous theories within the discipline of positive psychology have sought to encapsulate and explain the nature of well-being, a term which Ryan and Deci (2001) define as "optimal experience and functioning." Among these theories, two general competing viewpoints have been adopted: theories of *hedonic motivation* suggest that people focus on maximizing pleasure and minimizing pain to achieve well-being, whereas theories of *eudaimonic motivation* argue that people attain well-being through authentic, virtuous living and the pursuit of activities which facilitate human growth (Ryan & Deci, 2001).

For the purposes of this project, I have chosen to operationalize psychological well-being through the lens of Ryan and Deci's (2000) own Self-Determination Theory (SDT), which operates from a eudaimonic perspective. SDT defines three "innate psychological needs" which motivate people to grow and function in a way which is conducive to well-being: autonomy, competence, and relatedness (Ryan & Deci, 2000). I chose to focus on SDT because it is an elegant and easily understandable model for well-being and because its three components can be easily understood and applied to the context of homelessness. All three components are correlates of quality of life in individuals experiencing homelessness (Krabbenborg, Boersma, van der Veld, Vollebergh, & Wolf, 2017). Additionally, the fulfillment of the psychological needs posited by SDT can predict beneficial mental and physical health outcomes (Ng et al., 2012).

Autonomy is defined as self-regulation and is a similar concept to freedom and choice (Ryan & Deci, 2006). A survey of homeless young adults demonstrated that autonomy indirectly

impacted quality of life through the mediator of psychological distress (Krabbenborg et al., 2017). That is, feelings of autonomy reduce psychological distress, which results in improved quality of life (Krabbenborg et al., 2017). Reduced autonomy can contribute to the onset of psychopathology (Ryan & Deci, 2006). Additionally, autonomy predicts intrinsic motivation, a pattern of doing things for one's own interest, enjoyment, or satisfaction (Ryan & Deci, 2000). Intrinsic motivation in turn boosts self-esteem, a characteristic which promotes resilience and mitigates symptoms of depression and suicidality in individuals experiencing homelessness (Kidd & Shahar, 2008; Votta & Farrell, 2009). Self-esteem also generally improves positive affect and life satisfaction in individualistic cultures (Diener & Diener, 1995; Kwan, Bond, & Singelis, 1997). Low self-esteem in homeless populations increases the risk of drug abuse (Unger, Kipke, Simon, Montgomery, & Johnson, 1997).

What Ryan and Deci (2000) define as competence is a person's *perceived* ability level for a certain task. Out of SDT's three basic psychological needs, competence has the strongest impacts on quality of life on individuals experiencing homelessness (Krabbenborg et al., 2017). A mindset of perceived competence directly improves quality of life and has indirect positive effects on quality of life through the mediators of psychological distress and perceived social support (Krabbenborg et al., 2017). Additionally, higher levels of perceived competence are associated with improved intrinsic motivation and self-esteem (Ryan & Deci, 2000; Votta & Farrell, 2009).

Relatedness encompasses the needs for connectedness and belonging with other people (Ryan & Deci, 2000). It is unsurprising that the indirect relationship between relatedness and quality of life is mediated by social support for individuals experiencing homelessness (Krabbenborg et al., 2017). Somewhat more unexpectedly, relatedness also is associated with

levels of intrinsic motivation (Ryan & Deci, 2000). Furthermore, relationship quality improves self-esteem, particularly in collectivistic cultures (Kwan et al., 1997; Du, King, & Chi, 2017). Quality of relationships have repeatedly been shown to be a strong predictor of psychological well-being (Ryan & Deci, 2001).

Synthesis: Interactions between Environmental Characteristics and Well-Being

The following section will provide a general synthesis of the literature on environmental stress and the literature on SDT. Consequences of the five environmental factors explored previously will be examined specifically with regard to outcomes of autonomy, competence, and relatedness. Additional impacts of these factors on psychological well-being for individuals experiencing homelessness will be reviewed throughout this section. This section is designed to summarize the effects of the environment on basic psychological needs so that the potential need deprivations experienced in homeless populations can be better understood.

The most obvious interplay between environments and well-being occurs with regard to physical-social environment, particularly since relatedness is one of the three basic psychological needs posited by SDT. Crowding is likely to diminish psychological well-being by reducing the quality of relationships. Since high-density environments can cause social overload and lead to withdrawal and aggression (Saegert, 1978, pp. 260-261; Kuo & Sullivan, 2001; Regoeczi, 2003), these environments should reduce relationship quality. Additionally, the negative relational consequences of high-density living situations are magnified when people lack resources and are unfamiliar with the other residents of the spaces around them (Saegert, 1978, p. 263). Both of these exacerbating factors are often present for individuals experiencing homelessness, whether they are living in a crowded shelter or a crowded unsheltered space.

Neighborhood environments also play an impact on the fulfillment of relational needs through aggression. Green space, for example, diminishes aggressive behavior in adolescents (Younan et al., 2016). Among the social characteristics of neighborhoods, neighborhood poverty positively correlates with crime and segregation and inversely correlates with social cohesion and capital (Suglia et al., 2016). All these correlations have potential to reduce relatedness in a community.

Additionally, subpar social neighborhood outcomes can lead to higher rates of obesity in low-SES neighborhoods (Suglia et al., 2016). Suglia et al. (2016) also model relationships in which characteristics of the neighborhood built environment can reduce physical activity and predict neighborhood obesity. For certain individuals, such as adolescents and those who have negative attitudes about obesity, experiencing obesity can reduce self-esteem, a correlate of competence and autonomy (Griffiths, Parsons, & Hill, 2010; Klaczynski, Goold, & Mudry, 2004; Ryan & Deci, 2000). Obesity can additionally impact physical and relational competence in adolescents (Griffiths et al., 2010).

Purely physical characteristics of the environment also impact the basic psychological needs outlined by SDT. One of the most studied consequences that noise pollution, thermal stress, and air pollution can have upon psychological health is that the fulfillment of physiological needs can preempt the fulfillment of psychological needs (Maslow, 1943). Noise, thermal stress, and air pollution all have adverse physiological effects, (Muzet, 2007; Romaszko et al., 2017; Pope & Dockery, 2006) and the immediate health problems occurring due to these environmental stressors may result in a reduced focus on the fulfillment of autonomy, competence, and relatedness.

Physical environmental stress is often uncontrollable for individuals experiencing homelessness, and a lack of control over environmental stressors often exacerbates negative outcomes (Alloy et al., 1984). Literature on educational and social environments uses a dichotomy between autonomy-supportive and controlling structures (Dickinson, 1995; Oliver, Markland, Hardy, & Petherick, 2008). Controlling environments reduce a person's autonomy, reducing choice and implementing a reward-punishment system (Oliver et al., 2008). Individuals experiencing homelessness suffer from learned helplessness (Goodman, Saxe, & Harvey, 1991), which can result from exposure to uncontrollable noise (Alloy et al., 1984). Those facing chronic homelessness perceive themselves to be less in control of their environment than even those who are in a period of short-term homelessness (Saade & Winkelman, 2002). Future research should examine the broader effects of uncontrollable and adverse environmental stimuli on learned helplessness and autonomy.

The physical environmental factors previously addressed in this paper also predict levels of aggression (Evans & Jacobs, 1982, p. 116; Simister & Cooper, 2005; Dzhambov & Dimitrova, 2014). This response could come about in part due to the often-uncontrollable nature of thermal stress, air pollution, and noise. People can react with aggressive or antisocial behaviors when they feel they are being controlled (Moller & Deci, 2009), and while environmental stressors involve no direct controller, they do often involve situations outside of the individual's control. This aggressive response to autonomy deprivation could be particularly noteworthy for homeless individuals, who already feel they are not in control of their situations (Saade & Winkelman, 2002). Aggressive behaviors, in any case, are likely to adversely impact a person's sense of relatedness.

On the other hand, helping behavior can be reduced by environmental stressors (Cohen & Weinstein, 1982, pp. 54-56; Bell & Greene, 1982, p. 95). Helping behavior is likely in many situations to fulfill the psychological need for relatedness for both the helper and the one being helped. Additionally, promoting autonomy can facilitate helping behavior and promote greater psychological need satisfaction for both the helper and the recipient of the help (Gagné, 2003; Weinstein & Ryan, 2010).

Finally, researchers argue that environmental stress is generally and inextricably linked to the autonomy/control dichotomy: Evans (1982, p. 9) argues that "environmental conditions are stressful to the extent they interfere with individuals [sic] needs for control over their environment." This proposition suggests that the psychological need for autonomy as outlined by SDT underlies the very mechanism of environmental stress, a hypothesis which needs more research to verify as a rule, but one for which there is much corroborating data with regards to the impacts of individual uncontrollable environmental stressors.

Ethical Justifications for Future Research

Due to the numerous, complex, and sometimes surprising consequences of physical and social environmental stimuli on psychological well-being, I am of the opinion that future research on human-environment studies is a worthy pursuit. Additionally, I would argue that since these interactions between humans and the environment are not often well-known to the general public, better public education about these topics is necessary. While a large amount of good research has been completed from a variety of disciplines and perspectives in the field of human-environment studies, gaps in the literature still exist. For example, the effects of noise on mental health are ambiguous and seem to be situation-dependent. Interested scientists should

examine where knowledge is lacking and pursue answers. Finally, no previous academic works have to my knowledge synthesized research on environmental stressors and psychological well-being and applied this synthesis to the circumstances of individuals experiencing homelessness; therefore, I would suggest that future research take into consideration the unique role that environmental stimuli can play in the well-being and health of individuals facing housing insecurity.

However, my personal observations and opinions are not sufficient to necessitate future research on these topics. I will therefore argue the importance of gaining new understanding about psychological well-being, environmental factors, and homelessness from the lens of two ethical frameworks: Rawls' Theory of Justice as outlined by Hartman (1984) and the Capabilities Approach outlined by Nussbaum (2011) and Sen (2005).

Hartman (1984, pp. 115-117) elaborates Rawls' Theory of Justice as being composed of two principles of a just society. The first of these principles protects equal rights to equal basic liberties; the second argues that inequalities should only persist if one can reasonably expect them to work towards the advantage of all members of the society, and if the favorable side of these inequalities can be attained by all members of the society (Hartman, 1984, pp. 115-116). Hartman (1984, pp. 117-120) also argues that society should seek to benefit most those who have taken the brunt of natural and unmerited inequality. He suggests that society take into account an understanding of redress, in which resources are unequally utilized to benefit those who are in unfavorable positions in society (Hartman, 1984, pp. 117-118).

This conception of using resources unequally to promote the well-being of those who have fewer resources to begin with allows quite easily for an ethical obligation to help those experiencing homelessness. It follows that academic resources, as well as economic and service

resources, should be allotted to alleviate the adversities faced during bouts of housing instability. If we assume that scientific research is a positive resource which can serve to promote well-informed policies and services, it stands to reason that future research on well-being and homelessness could contribute to a more just society.

Adding additional ethical merit to the study of homelessness and housing insecurity is Hartman's (1984, pp. 115-116) idea of which natural and social goods are fundamental enough to be protected and supported in a just society. Fundamental social goods include basic rights and liberties, among which are freedom of thought and freedom of the person; these resources can be dispensed by society and should be distributed justly according to the two principles (Hartman, 1984, pp. 115-116). Primary natural goods available to the individual include health and intelligence; these are not so easily controlled by society, but natural inequalities should be considered with redress in mind as the just society allots its resources (Hartman, 1984, pp. 116-118).

The fundamental social goods map well onto SDT's understanding of human autonomy, while the primary natural goods relate to the psychological need for competence. Research into autonomy and competence in the context of psychological well-being can therefore contribute to a greater enactment of justice in society, since policymakers and service organizations must understand the factors which impact these basic needs in order to enact programs that promote well-being for underserved populations such as those experiencing homelessness.

As discussed in the research sections above, the environmental stressors addressed in this paper can have consequences on the availability of such goods as freedom of the person and health. This adds motivation for researchers in a society seeking justice to understand more fully the multitudinous effects of physical and social environments on health and well-being.

The Capabilities Approach, also known as the Human Development Approach, offers another perspective from which to ethically justify the continued study of environmental stressors, homelessness, and well-being. Sen (2005) argues that capabilities are a type of freedom involving both opportunity and process: freedom of opportunity entails the ability to decide what one wants to do, and freedom of process involves being able to carry out one's own actions with choice. Both of these central liberties to the Capabilities Approach fulfill the psychological need for autonomy as defined by SDT. Environmental conditions which degrade autonomy thus impede a person's freedom to pursue human capabilities.

The capabilities approach relates to the present research topics not only in overarching theory but also in concrete practice. Many of the ten fundamental Central Capabilities suggested by Nussbaum (2011, pp. 33-34) relate directly to the study of human-environment studies in the context of homelessness.

The first two of these basic necessities for human development are life and bodily health (Nussbaum, 2011, p. 33). The many adverse physiological and psychological health outcomes outlined in the research sections of this paper are convincing enough that environmental stressors detract from the pursuit of human capabilities. If that were not enough, many deleterious physiological health outcomes to these stimuli (particularly in the case of air pollution) were only skimmed over or ignored entirely in this paper in order to maintain the focus on psychological well-being.

Nussbaum also lists senses and imagination, emotions, and practical reason as Central Capabilities for human development (Nussbaum, 2011, pp. 33-34). These three characteristics are germane to the study of environmental stress due to the effects of environment on mental

illnesses, which can inhibit an individual's cognitions and affect. Additionally, the capability for emotions relates well to the need for relatedness as defined by SDT.

Nussbaum's tenth and final Central Capability is control over one's environment (Nussbaum, 2011, p. 34). This captures the relationship between SDT's concept of autonomy and a person's interactions with their surroundings. This is the most direct ethical argument the Capabilities Approach gives for the continued application of human-environment studies to the circumstances of homelessness. If the promotion of capabilities is a human right, as argued by Sen (2005), then society must seek to mitigate the influence of environmental stressors on individuals experiencing homelessness. The research outlined above makes a case that characteristics of the physical and social environment can adversely affect feelings of autonomy and control over the environment for individuals experiencing homelessness, leading to psychological and physiological stress. Future researchers, service organizations, and policymakers would thus do well to seek out evidence-driven ways to promote human development by facilitating environmental autonomy and mitigating environmental stress for individuals experiencing homelessness.

Works Cited

Abramson, L. Y., Seligman, M. E. P., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*(1), 49-74.

Alloy, L. B., Peterson, C., Abramson, L. Y, & Seligman, M. E. P. (1984). Attributional style and generality of learned helplessness. *Journal of Personality and Social Psychology, 46*(3), 681-687.

Anderson, C. A. (1989). Temperature and aggression: Ubiquitous effects of heat on occurrence of human violence. *Psychological Bulletin, 106*(1), 74-96.

Anderson, C. A. (2001). Heat and violence. *Current Directions in Psychological Science, 10*(1), 33-38. https://doi.org/10.1111/1467-8721.00109

Baum, A., Singer, J. E., & Baum, C. S. (1982). Stress and the environment. In G. W. Evans (Ed.), *Environmental stress* (pp. 15-44). Cambridge: Cambridge University Press.

Bell, P. A., & Greene, T. C. (1982). Thermal stress: Physiological comfort, performance, and social effects of hot and cold environments. In G. W. Evans (Ed.), *Environmental stress* (pp. 75-104). Cambridge: Cambridge University Press.

Biermann, T., Stilianakis, N., Bleich, S., Thürauf. N., Kornhuber, J., & Reulbach, U. (2009). The hypothesis of an impact of ozone on the occurrence of completed and attempted suicides. *Medical Hypotheses, 72,* 338-341.

Calderón-Garcidueñas, L., Maronpot, R. R., Torres-Jardón, R., Henriquez-Roldan, C., Schoonhoven, R., Acuna-Ayala, H., Villarreal-Calderon, A., …, & Swenberg, J. A. (2003). DNA damage in nasal and brain tissue of canines exposed to air pollutants is associated with evidence of chronic brain inflammation and neurodegeneration. *Toxicologic Pathology, 31,* 524-528. DOI: 10.1080/01926230390226645

Calderón-Garcidueñas, L., Leray, E., Heydarpour, P., Torres-Jardón, R., & Reis, J. (2016). Air pollution, a rising environmental risk factor for cognition, neuroinflammation, and neurodegeneration: The clinical impact on children and beyond. *Revue Neurologique, 172*(1), 69-80. https://doi.org/10.1016/j.neurol.2015.10.008

Cohen, S., Glass, D. C., & Singer, J. E. (1973). Apartment noise, auditory discrimination, and reading ability in children. *Journal of Experimental Social Psychology, 9*, 407-422.

Cohen, S., & Weinstein, N. (1982). Nonauditory effects of noise on behavior and health. In G. W. Evans (Ed.), *Environmental stress* (pp. 45-74). Cambridge: Cambridge University Press.

Chamie, J. (2017, July). As cities grow worldwide, so do the numbers of homeless. Retrieved March 16, 2019, from https://yaleglobal.yale.edu/content/cities-grow-worldwide-so-do-numbers-homeless

Christian, H., Zubrick, S. R., Foster, S., Giles-Corti, B., Bull, F., Wood, L., Knuiman, M., …, & Boruff, B. (2015). The influence of the neighborhood physical environment on early child health and development: A review and call for research. *Health & Place*, *33*, 25-36. https://doi.org/10.1016/j.healthplace.2015.01.005

Dickinson, L. (1995). Autonomy and motivation: A literature review. *System, 23*(2), 165-174. https://doi.org/10.1016/0346-251X(95)00005-5

Diener, E., & Diener, M. (1995). Cross-cultural correlates of life satisfaction and self-esteem. *Journal of Personality and Social Psychology*, *68*(4), 653-663. http://dx.doi.org/10.1037/0022-3514.68.4.653

Du, H., King, R. B., & Chi, P. (2017). Self-esteem and subjective well-being revisited: The roles of personal, relational, and collective self-esteem. *PLoS ONE, 12*(8): e0183958. https://doi.org/10.1371/journal.pone.0183958

Dzhambov, A., & Dimitrova, D. (2014). Neighborhood noise pollution as a determinant of displaced aggression: A pilot study. *Noise & Health, 16*(69), 95-101.

Evans, G. W. (1982). General introduction. In G. W. Evans (Ed.), *Environmental stress* (pp. 1-11). Cambridge: Cambridge University Press.

Evans, G. W. (2003). The built environment and mental health. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 80*(4), 536-555.

Evans, G. W., & Jacobs, S. V. (1982). Air pollution and human behavior. In G. W. Evans (Ed.), *Environmental stress* (pp. 105-132). Cambridge: Cambridge University Press.

Evans, G. W., Palsane, M. N., Lepore, S. J., & Martin, J. (1989). Residential density and psychological health: The mediating effects of social support. *Journal of Personality and Social Psychology, 57*(6), 994-999.

Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motivation and Emotion, 27*(3), 199-223.

Genc, S., Zadeoglulari, Z., Fuss, S. H., & Genc, K. (2011). The adverse effects of air pollution on the nervous system. *Journal of Toxicology.* DOI: 10.1155/2012/782462

Glass, D. C., & Singer, J. E. (1972). *Urban stress: Experiments on noise and social stressors*. New York: Academic Press.

Goodman, L., Saxe, L., & Harvey, M. (1991). Homelessness as psychological trauma: Broadening perspectives. *American Psychologist, 46*(11), 1219-1225.

Graumann, C. F. (2002). The phenomenological approach to people-environment studies. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 95-113). New York: John Wiley & Sons, Inc.

Griffiths, L. J., Parsons, T. J., & Hill, A. J. (2010). Self-esteem and quality of life in obsess children and adolescents: A systematic review. *International Journal of Pediatric Obesity, 5*, 282-304. DOI: 10.3109/17477160903473697

Gueguen, N. (2001). Effect of a perfume on prosocial behavior of pedestrians. *Psychological Reports, 88*, 1046-1048.

Haines, M. M., Stansfeld, S. A., Job, R. F. S., Berglund, B., & Head, J. (2001). Chronic aircraft noise exposure, stress responses, mental health and cognitive performance in school children. *Psychological Medicine, 31*, 265-277.

Hancock, P. A., & Vasmatzidis, I. (2003). Effects of heat stress on cognitive performance: The current state of knowledge. *International Journal of Hyperthermia, 19*(3), 355-372.

Hartman, R. H. (1984). *Poverty and economic justice: A philosophical approach.* New York: Paulist Press

Henry, M., Mahathey, A., Morrill, T., Robinson, A., Shivji, A., & Watt, R. (2018, December). The 2018 Annual Homeless Assessment Report (AHAR) to Congress. Retrieved February 7, 2019, from https://www.hudexchange.info/resources/documents/2018-AHAR-Part-1.pdf

Jakovljevic, B., Belojevic, G., Paunovic, K., & Stojanov, V. (2006). Road traffic noise and sleep disturbances in an urban population: Cross-sectional study. *Croatian Medical Journal, 47*, 125-133.

James, A. L. (2006). The effects of odor on compliance and willingness to volunteer. *Journal of Undergraduate Psychological Research, 1*, 13-17.

Jones, J. W., & Bogat, G. A. (1978). Air pollution and human aggression. *Psychological Reports, 43*, 721-722.

Kennedy, D. P., Gläscher, J., Tyszka, M., & Adolphs, R. (2009). Personal space regulation by the human amygdala. *Nature Neuroscience, 12*(10), 1226-1227. DOI: 10.1038/nn.2381.

Khadduri, J., Culhane, D., Leopold, J., Rothschild, L., & Cortes, A. (2010, December). The 2010 Annual Homeless Assessment Report (AHAR) to Congress. Retrieved March 7, 2019, from https://www.hudexchange.info/resources/documents/2010HomelessAssessmentReport.pdf

Kim, C., Jung, S. H., Kang, D. R., Kim, H. C., Moon, K. T., Hur, N. W., Shin, D. C., & Suh, I. (2010). Ambient particulate matter as a risk factor for suicide. *The American Journal of Psychiatry, 167*(9), 1100-1107. https://doi.org/10.1176/appi.ajp.2010.09050706

Kim, Y., Myung, W., Won, H.-H., Shim, S., Jeon, H. J., Choi, J., Carroll, B. J., & Kim, D. K. (2015). Association between air pollution and suicide in South Korea: A nationwide study. *PLoS ONE, 10*(2): e0117929. https://doi.org/10.1371/journal.pone.0117929

Kidd, S., & Shahar, G. (2008). Resilience in homeless youth: The key role of self-esteem. *American Journal of Orthopsychiatry, 78*(2), 163-172.

Klaczynski, P. A., Goold, K. W., & Mudry, J. J. (2004). Culture, obesity stereotypes, self-esteem, and the “thin ideal”: A social identity perspective. *Journal of Youth and Adolescence, 33*(4), 307-317.

Krabbenborg, M. A. M., Boersma, S. N., van der Veld, W. M., Vollebergh, W. A. M., & Wolf, J. R. L. M. (2017). Self-determination in relation to quality of life in homeless young adults: Direct and indirect effects through psychological distress and social support. *The Journal of Positive Psychology, 12*(2), 130-140. DOI: 10.1080/17439760.2016.1163404

Kryter, K. D. (1970). *The effects of noise on man.* New York: Academic Press.

Kuo, F. E., & Sullivan, W. C. (2001). Aggression and violence in the inner city: Effects of environment via mental fatigue. *Environment and Behavior, 33*(4), 543-571.

Kwan, V. S. Y., Bond, M. H., & Singelis, T. M. (1997). Pancultural explanations for life satisfaction: Adding relationship harmony to self-esteem. *Journal of Personality and Social Psychology, 73*(5), 1038-1051. http://dx.doi.org/10.1037/0022-3514.73.5.1038

Laschewski, G., & Jendritzky, G. (2002). Effects of the thermal environment on human health: An investigation of 30 years of daily mortality data from SW Germany. *Climate Research, 21*, 91-103.

Lawrence, R. J. (2002). Healthy residential environments. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 394-412). New York: John Wiley & Sons, Inc.

Lepore, S. J., Evans, G. W., & Palsane, M. N. (1991). Social hassles and psychological health in the context of chronic crowding. *Journal of Health and Social Behavior, 32*, 357-367.

Lercher, P., Evans, G. W., Meis, M., Kofler, W. W. (2002). Ambient neighbourhood noise and children's mental health. *Occupational and Environmental Medicine, 59*, 380-386.

Lopez-Sanchez, J. I. (2018). Thermal effects on cognition: A new quantitative synthesis. *International Journal of Hyperthermia, 34*(4), 423-431.

Ma, J., Li, C., Kwan, M. P., & Chai, Y. (2018). A multilevel analysis of perceived noise pollution, geographic contexts and mental health in Beijing. *International Journal of Environmental Research and Public Health, 15*, 1479-1496. DOI: 10.3390/ijerph15071479

Maeng, A., & Tanner, R. J. (2013). Construing in a crowd: The effects of social crowding on mental construal. *Journal of Experimental Social Psychology, 49*(6), 1084-1088. https://doi.org/10.1016/j.jesp.2013.07.010

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370-396. http://dx.doi.org/10.1037/h0054346

McMichael, A. J., Woodruff, R. E., & Hales, S. (2006). Climate change and human health: Present and future risks. *Lancet, 367*, 859-869. DOI: 10.1016/S0140-6736(06) 68079-3

Moller, A. C., & Deci, E. L. (2009). Interpersonal control, dehumanization, and violence: A self-determination theory perspective. *Group Processes & Intergroup Relations, 13*(1), 41-53. DOI: 10.1177/1368430209350318

Muzet, A. (2007). Environmental noise, sleep and health. *Sleep Medicine Reviews, 11*, 135-142.

Ng, J. Y. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325-340. DOI: 10.1177/1745691612447309

Nolte, C. G., Dolwick, P., Spero, T. L., Brown, A. C., Phillips, S., & Anenberg, S. (2014). The geographic distribution and economic value of climate change-related ozone health impacts in the United States in 2030. *Journal of the Air & Waste Management Association, 65*(5), 570-580. https://doi.org/10.1080/10962247.2014.996270

Nussbaum, M. C. (2011). The central capabilities. In *Creating capabilities: The human development approach* (pp. 17-45). Cambridge, MA: The Belknap Press of Harvard University Press.

Oliver, E. J., Markland, D., Hardy, J., & Petherick, C. M. (2008). The effects of autonomy-supportive versus controlling environments on self-talk. *Motivation and Emotion, 32*(3), 200-212.

Pope, C. A., & Dockery, D. W. (2006). Health effects of fine particulate air pollution: Lines that connect. *Journal of the Air & Waste Management Association, 56*, 709-742.

Popenoe, D. (1973). Urban residential differentiation: An overview of patterns, trends, and problems. *Sociological Inquiry, 43*(3-4), 35-56.

Ramin, B., & Svoboda, T. (2009). Health of the homeless and climate change. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 86*(4), 654-664. DOI: 10.1007/s11524-009-9354-7

Regoeczi, W. C. (2003). When context matters: A multilevel analysis of household and neighbourhood crowding on aggression and withdrawal. *Journal of Environmental Psychology, 23*(4), 457-470.

Romaszko, J., Cymes, I., Draganska, E., Kuchta, R., & Glinska-Lewczuk, K. (2017). Mortality among the homeless: Causes and meteorological relationships. *PLoS ONE, 12*(12): e0189938. https://doi.org/10.1371/journal.pone.0189938

Rotton, J., & Cohn, E. G. (2000). Violence is a curvilinear function of temperature in Dallas: A replication. *Journal of Personality and Social Psychology, 78*(6), 1074-1081.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68-78.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52,* 141-166.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74*(6), 1557-1586.

Saade, R., & Winkelman, C. (2002). Short- and long-term homelessness and adolescents' self-esteem, depression, locus of control and social supports. *Australian Journal of Social Issues, 37*(4), 431-445.

Saegert, S. (1978). High-density environments: Their personal and social consequences. In A. Baum & Y. M. Epstein (Eds.), *Human response to crowding* (pp. 257-281). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publishers.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14.

Sen, A. (2005). Human rights and capabilities. *Journal of Human Development, 6*(2), 151-166. DOI: 10.1080/14649880500120491

Simister, J., & Cooper, C. (2005). Thermal stress in the U.S.A.: Effects on violence and on employee behavior. *Stress and Health, 21*, 3-15.

Simister, J., & Van de Vliert, E. (2005). Is there more violence in very hot weather? Tests over time in Pakistan, and across countries worldwide. *Pakistan Journal of Meteorology, 2*(4), 51-66.

Stansfeld, S. A., & Matheson, M. P. (2003). Noise pollution: Non-auditory effects on health. *British Medical Bulletin, 68*, 243-257.

Sundquist, K, Hamano, T., Li, X., Kawakami, N., Shiwaku, K., & Sundquist, J. (2014). Linking social capital and mortality in the elderly: A Swedish national cohort study. *Experimental Gerontology, 55*, 29-36.

Szyszkowicz, M. (2007). Air pollution and emergency department visits for depression in Edmonton, Canada. *International Journal of Occupational Medicine and Environmental Health, 20*(3), 241-245. DOI: 10.2478/v10001-007-0024-2

Szyszkowicz, M., Willey, J. B., Grafstein, E., Rowe, B. H., & Colman, I. (2010). Air pollution and emergency department visits for suicide attempts in Vancouver, Canada. *Environmental Health Insights, 4*, 79-86. DOI: 10.4137/EHI.S5662

Tawatsupa, B., Lim, L. L-Y., Kjellstrom, T., Seubsman, S., Sleigh, A., & the Thai Cohort Study team. (2010). The association between overall health, psychological distress, and occupational heat stress among a large national cohort of 40,913 Thai workers. *Global Health Action, 3*(1). DOI: 10.3402/gha.v3i0.5034

Thompson, C. W., Aspinall, P., & Roe, J. (2014). Access to green space in disadvantaged urban communities: Evidence of salutogenic effects based on biomarker and self-report measures of well-being. *Procedia – Social and Behavioral Sciences, 153*, 10-22. DOI: 10.1016/j.sbspro.2014.10.036

Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Clow, A., & Miller, D. (2012). More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning, 105*(3), 221-229.

Unger, J. B., Kipke, M. D., Simon, T. R., Montgomery, S. B., & Johnson, C. J. (1997). Homeless youths and young adults in Los Angeles: prevalence of mental health problems and the

relationship between mental health and substance abuse disorders. *American Journal of Community Psychology, 25*(3), 371-394.

Votta, E., & Farrell, S. (2009). Predictors of psychological adjustment among homeless and housed female youth. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 18*(2), 126-132.

Weinstein, N., & Ryan, R. M. (2010). When helping helps: Autonomous motivation for prosocial behavior and its influence on well-being for the helper and recipient. *Journal of Personality and Social Psychology, 98*(2), 222-244. DOI: 10.1037/a0016984

Worchel, S., & Teddlie, C. (1976). The experience of crowding: A two-factor theory. *Journal of Personality and Social Psychology, 34*(1), 30-40.

Wright, D. M., Newell, K., Maguire, A., & O'Reilly, D. (2018). Aircraft noise and self-assessed mental health around a regional urban airport: a population based record linkage study. *Environmental Health, 17*(74). https://doi.org/10.1186/s12940-018-0418-6

Yang, A. C., Tsai, S.-J., & Huang, N. E. (2011). Decomposing the association of completed suicide with air pollution, weather, and unemployment data at different time scales. *Journal of Affective Disorders, 129*(1-3), 275-281. https://doi.org/10.1016/j.jad.2010.08.010

Younan, D., Tuvblad, C., Li, L., Wu, J., Lurmann, F., Franklin, M., Berhane, K., …, & Chen, J.-C. (2016). Environmental determinants of aggression in adolescents: Role of urban neighborhood greenspace. *Journal of the American Academy of Child and Adolescent Psychiatry, 55*(7), 591-601. DOI: 10.1016/j.jaac.2016.05.002.