

# Academy Journal No. 22

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## **Mission of the *Academy Journal***

As the official journal of the AIA Academy of Architecture for Health (AAH), this publication explores subjects of interest to AAH members and others involved in the fields of health care architecture, planning, design, and construction. The goal is to promote awareness, educational exchange, and advancement of the overall project delivery process, building products, and medical progress that affect all involved in those fields.

## **About AAH**

AAH is one of 21 member communities of The American Institute of Architects (AIA). AAH is unique in the depth of its collaboration with professionals from all sectors of the health care community, including physicians, nurses, hospital administrators, facility planners, engineers, managers, health care educators, industry and government representatives, product manufacturers, health care contractors, specialty subcontractors, allied design professionals, and health care consultants.

AAH currently consists of approximately 7,000 members. Its mission is to provide knowledge which supports the design of healthy environments by creating education and networking opportunities for members of – and those touched by – the healthcare architectural profession.

Please visit our website at [aia.org/aah](http://aia.org/aah) for more about our activities. Please direct any inquiries to [aah@aia.org](mailto:aah@aia.org).

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# About the journal

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As we start the 23rd year of the Academy Journal, published by the AAH Knowledge Community, this edition includes articles that support the enhancement of the built environment for health care.

As the official publication of the Academy, the Journal publishes articles of particular interest to AIA members and the public involved in the fields of health care architecture, planning, design, research, and construction. The goal has always been to expand and promote awareness, educational exchange, and advancement of the overall project delivery process, building products, and medical progress that affects all involved in those fields.

Articles are submitted to, and reviewed by, an experienced, nationally diverse editorial review committee (ERC) of medical and architectural professionals. Over the years, the committee has reviewed hundreds of submissions, responded to writers' inquiries, and encouraged and assisted writers in achieving publication. In its over 20-year history, the Journal has provided valuable opportunities for new and seasoned authors from the architecture and health care professions, including architects, physicians, nurses, other health care providers, academics, research scientists, and students from the US and foreign countries.

Published articles have explored a broad range of medical topics, including research trends, the future of health care architecture, cardiac care, future and evolving technology, patient rooms and patient safety, lighting design for health care, psychology, workplace design, cancer care environments, emergency care, women's and children's care, and various health care project delivery methods.

We encourage graduates who have received health care research scholarships and others involved with research within the health care architecture field to submit their research to the Journal for publication consideration. We will continue to develop a cross-referenced article index and a broader base of writers and readers. The deadline for the 2021 call for papers is May 27, 2021.

Since the late 1990s, this free publication has expanded to include worldwide distribution. And we are proud to report that as our readership continues to grow, it also expands internationally. Readers have viewed the Journal online from the US, Canada, Europe, the Caribbean, Asia, Africa, India, and Saudi Arabia, just to name a few. The Journal is available to the 94,000 AIA members and the public on the AIA website at [aia.org/aah](http://aia.org/aah).

Special thanks to AIA for its continued support and hard-working staff and to the many volunteers who have contributed to our growing and continued success including Doug Paul and Southern Ellis for their leadership on behalf of the AIA and AAH. I would especially like to thank the other members of the 2020 ERC: Donald L. Myers, AIA, NCARB; Angela Mazzi, AIA, ACHA, EDAC; Sharon Woodworth, FAIA, FACHA; Dale A. Anderson, AIA, NCARB, LEED AP BD+C, CSBA, EDAC, MBA, GGP, ACHA; and Erin McNamara, EDAC. As always, we appreciate your feedback, comments and suggestions by emailing [aah@aia.org](mailto:aah@aia.org).

# Letter from the editor

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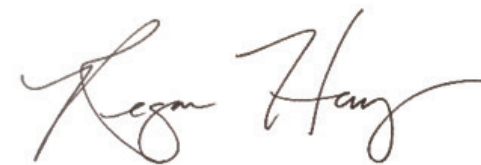
2020 has been a difficult year.

The COVID-19 global pandemic has impacted our lives in a profound way. Collectively, people have gained a new appreciation for the power of a virus and its potential impact to our hospitals, economy, and social networks. Our friends and colleagues in healthcare have been tested in a manner that will have meaningful consequences on the industry and what it means to dedicate one's life to care for another. Many of us have waited on news from scientists, cheered for progress, and followed FDA trials with great anticipation and awareness for the enormity of the pursuit. Never have I felt so appreciative of the people, networks, supply chains, and infrastructure that support our healthcare system.

As this journal goes to print, the death toll, in the United States, for COVID-19 stands around 300,000 and the first vials of vaccine are being administered to people on the frontline. There is great hope that we are at the beginning of the end of this saga, but still reeling from the exposed vulnerabilities to both the healthcare industry and society at large. We have learned so much and yet there is so much left to understand about the last ten months.

I look to 2021 and the years to follow as an opportunity to both celebrate our successes and learn from our missteps so that we are better and more prepared for future generations of frontline workers, patients in need, and vital equipment suppliers. There is great promise at the juncture between healthcare, design, and research. I applaud Orlando Maione for his vision to foster this journal and thank him for his many years of leadership and service as The Academy Journal Editor. We close out this year with an appreciation for the work accomplished and excitement for what is to come. I look forward to exploring with and learning from you in the years to come.

Cheers to a happy new year.



Regan Henry, RA, PhD, LEED AP, LSSBB  
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# Urban interventions to mitigate the adverse effects of occupational stress in office buildings

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## ABSTRACT

As the world's urban population continues to grow, so does the number of white-collar jobs that require employees to spend most of their waking hours in office buildings. It is more important than ever, therefore, to attend to those aspects of urban life that have significant effects on people's health and well-being. Work-related stress is one such risk factor, both for employees' mental and physical health as well as for organizational productivity. Although the sources of such occupational stress are varied, one significant contributor is the built environment. To mitigate occupational stress, there are, fortunately, three areas in which intervention through the built environment can be affected: architecture, the urban landscape (conjoined space), and urban planning. Of these three, the present paper focuses on urban planning factors, which can impact considerably the two other areas. In the beginning, I discuss the significance of the problem on both the individual and organizational levels and then explore the relationship between urban planning—and, specifically, the components of office placement and programming—and occupational stress. I then offer a set of strategies for mitigating stress that can be instituted during the early stages of the planning process.

## Introduction

Occupational stress has been a research topic in fields as diverse as health care, public health, neuroscience, psychology, social sciences, urban studies, environmental studies planning, medical sciences, and management. Fortunately, mental health is receiving more attention in architecture in recent years. However, most studies on occupational stress focus primarily on the general well-being of workers, addressing concerns such as productivity, satisfaction, and mental health; occupational stress is not typically the main focus. Isolating occupational stress as a primary risk factor is the main focus of this article. To address this gap in contemporary research, in this article, I identify the relationship between occupational stress and the built environment in the workplace during the planning stage through a systematic cross-disciplinary literature review.

Occupational Stress are mainly caused by psychological demands and lack of decision-making autonomy (WHO, 2002). Occupational stress occurs when an individual loses control over employment demands (Wright, 2007). If stress occurs frequently, it will cause distress, which itself is a condition of physical or mental suffering (Figueroa-Fankhanel, 2014). Further, distress can be classified as psychological, medical, and/or behavioral.

At the personal level, medical distresses are well-studied. Chronic stressors are associated with the destruction of both cellular and humoral procedures that can lead to heart disease, cancers, and musculoskeletal injuries, along

with related discomfort and disability (Quick & Henderson, 2016). At the organizational level, personal distress can greatly reduce the productivity of an organization due to an accumulation of personal dysfunctions or simply worsened work performance. Indeed, studies conducted in North America over the last decade have established that the work environment has a significant impact on employees because they spend at least 50% of their indoor time in the workplace (Fleury-Bahi, Pol, & Navarro, 2017). Occupational stress's adverse effects on the organization manifest as absenteeism, labor turnover, disability, and productivity decline (Czabała, Charzyńska, & Mroziak, 2011; Palmer & Dryden, 1994).

In a systematic review on productivity research studies and occupational stress, two main categories were identified for productivity improvement: (1) individual task productivity and (2) collaborative and teamwork productivity (Vischer, 2003). When it comes to individual tasks, lowering the stress level of employees might result in a higher quality of outputs, lower absenteeism rate, and in general, higher turnover (Vischer, 2003). Similarly, lower maintenance costs, lower error rates, smaller groups, cost reduction, better decision making, and fewer client complaints were found to be the result of mitigating the occupational on the collaborative and teamwork productivity in any organization (Vischer, 2003). Since most of an organization's operating costs are related to its staff, improving staff productivity by even as little as 1% can have a significant impact on the bottom line and a business's competitiveness (WGBC, 2016).

## Social determinants of health

The social determinant of health (SDOH) is an important factor in public health studies. The World Health Organization (WHO) defines SDOH as “the [set of] conditions in which people are born, grow, live, work and age” (WHO, 2012). Age and gender have emerged as particularly popular factors to investigate in recent occupational health studies. However, these recent studies, particularly those conducted by epidemiological researchers, have yielded a variety of findings, some of which, unfortunately, contradict each other. For instance, Kivimäki and Kawachi found that health differences between men and women, between younger versus older employees, and between workers from varying socioeconomic backgrounds appear to be small (Kivimäki & Kawachi, 2015). By contrast, Zsoldos and colleagues found a direct relationship between aging and experiencing occupational stress (Zsoldos, Mahmood, & Ebmeier, 2014). Their study shows that by aging, employees often become more vulnerable to stressors and face more age-related diseases and, as a result, choose to take early retirement. Moreover, older employees who are members of ethnic minority groups are more likely to face bullying and discrimination, which are extreme stressors (Zsoldos, Mahmood, & Ebmeier, 2014). Other groups who face high levels of stress are members of the working classes, immigrants, seasonal workers, and blue-collar workers (Li et al., 2015) since they have less control over their environment than do members of more privileged socioeconomic categories (Aronsson, 1989).

Another area that remains understudied is that of work-related stress and health problems in women, particularly. Among the few such studies, one of the more important was conducted by Beil and Hanes, who measured changes in salivary amylase (an enzyme) and the relationship between those changes and self-reported stress, finding higher stress levels in women than in men (Beil & Hanes, 2013). Interestingly, a study by Nielsen and colleagues found no association between stress and mortality among women; further, to their surprise, these researchers even found that highly stressed younger women are less vulnerable to cancer mortality than their male counterparts (Nielsen et al., 2008). This same study showed, though, those younger men were found to be at greater risk for stress-related cancer than were older men. Its authors concluded that greater attention should be given to prevention strategies for those presumably healthy men who face stress as a risk factor for premature death during middle age (Nielsen et al., 2008).

Despite these various contradictory findings, important consistencies have also been discovered. For example, many studies have shown that the risk of severe mental illness is higher in cities than in rural areas (Gruebner et al., 2017). That is why the focus of this article is on how environmental factors, such as location, adjacencies, and transportation, predominate in urban areas and contribute to occupational stress.

## Areas of intervention in the built environment

One of the areas of focus of public health, a growing, and increasingly multidisciplinary field, is the built environment and its role in social, economic, and medical policymaking. This should not be surprising, as public health professionals, more than ever, are involved directly in those aspects of community and community-based design that are related to architecture. As a result, architects, planners, designers, and other contributors to the creation of the urban built environment are increasingly aware of their role in supporting people’s health and well-being. Interventions to mitigate occupational stress need to be implemented at the levels of urban planning, policymaking, and site selection. Architectural intervention can then complement and complete stress mitigation strategies.

Fortunately, the importance of well-being and health is acknowledged by the industry and the market. In an AIA white paper, for example, the authors show that nearly three-quarters of US architects acknowledge that the health impacts of buildings influence their design decisions (Tinder & Schneidawind, n.d.). At the same time, standardization systems such as ULI, LEED, and WELL indicate that there is a high demand from owners and investors for healthier buildings.

Interventions for mitigating occupational stress in the built environment have been studied in three separate but inevitably related contexts: architecture, urban landscape (conjoint space), and urban planning (Diagram 1). Fortunately, there is a robust body of literature on urban and architecture interventions, including those based on the evaluation of physiology and biophilia hypothesis. While many factors contribute to occupational stress, research consistently shows that the primary factors are lack of control, night shift, the disproportion in effort-reward, high demands, poor work environment, social isolation, inactivity, and violence at work (Härmä, Kompier, & Vahtera, 2006; Smith & Beaton, 2008). One of the main causes of occupational stress is losing control over one’s environment, which can impact organizations both

on the individual and the collective level (Aronsson, 1989). Control here means that “individuals have to determine the influence on outcomes”(Aronsson, 1989). Environmental satisfaction, which impacts the psychological needs of employees, is another important factor; as researchers have shown, environmental satisfaction and stress have an adversarial relationship with each other (Tombs Singh, 2014).

Recent studies have identified four broad categories of workplace demands that cause distress: (1) task demands (occupation, careers, workload, job insecurity); (2) role demands (role conflict and ambiguity); (3) physical demands (temperature, lighting, workplace design); and (4) interpersonal demands (social density, personality conflicts, leadership style, group pressures) (Brown & Richerson, 2014; Quick & Henderson, 2016).

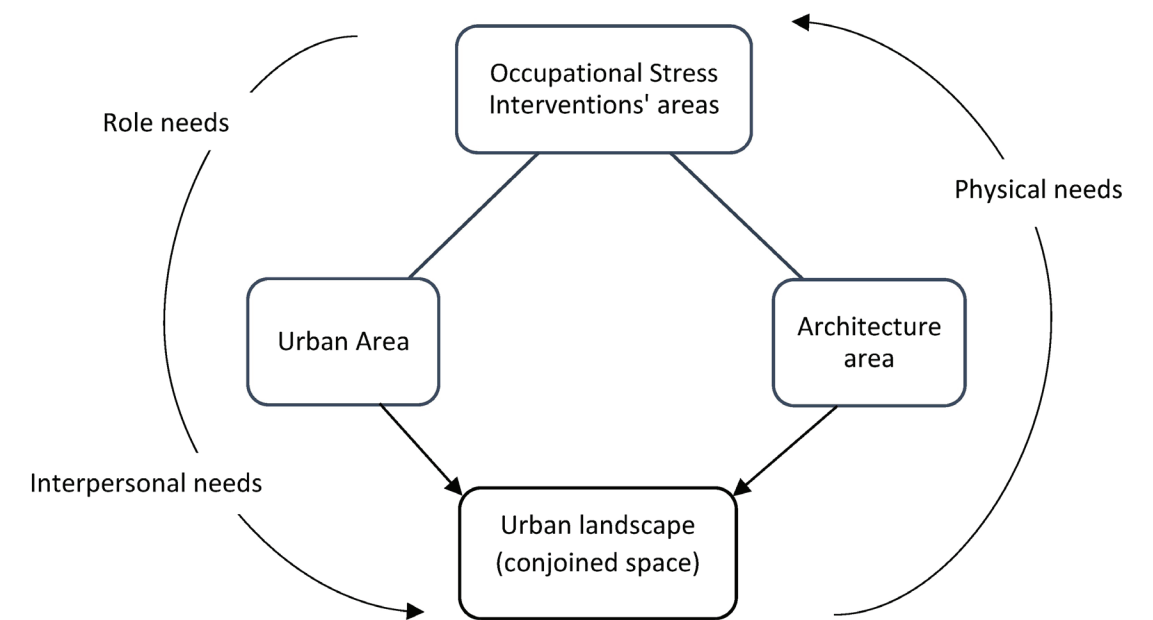
These four categories can be used as a framework for categorizing the design strategies for mitigating the occupational stress of employees. Task demands and physical demands relate to, or limit, the comfort level of employees; these include temperature-, light-, and sound-related strategies. Designers should also consider the physical needs that humans have to affiliate with nature. Access to nature can be either passive or active, engaging any or all of our senses (Winterbottom & Wagenfeld, 2015). Other strategies can focus on social behaviors and interpersonal demands, which mostly concern buildings’

interiors. However, when it comes to role demands, either personal or occupational, the urban configuration can play a significant part in mitigating tension caused by managing those roles. (See Diagram 1).

## The urban sector

In this section, I address the factors that cause stress on employees at the urban scale. In the urban context, the focus of recent research has been on location, general situation, and adjacencies, acknowledging that stress is an evolutionary response to the threat. Mitigating the adverse effects of stress in the urban context can be addressed by biophilia strategies. Biophilia is a hypothesis based on humans’ intrinsic tendencies, both neurological and physiological, to affiliate with nature (Browning, Ryan, & Clancy, 2012). To execute a biophilic design strategy, the building, occupants, location (context), and functional aspects of the design must be taken into consideration (Gillis & Gatersleben, 2015). In other words, the biophilic design should not be a temporary or isolated experience; rather, it must be a part of a comprehensive system that works with nature (Kellert, 2015). To achieve biophilic design, natural features must be considered in all areas of design in order to provide beneficial results for people (Kellert, 2015). Having more access to natural elements and more greenery in an urban area, for example, leads to a greater ability to cope with chronic stress. (See Diagram 2.)

DIAGRAM 1



The relation between areas of intervention, office buildings, and human needs.

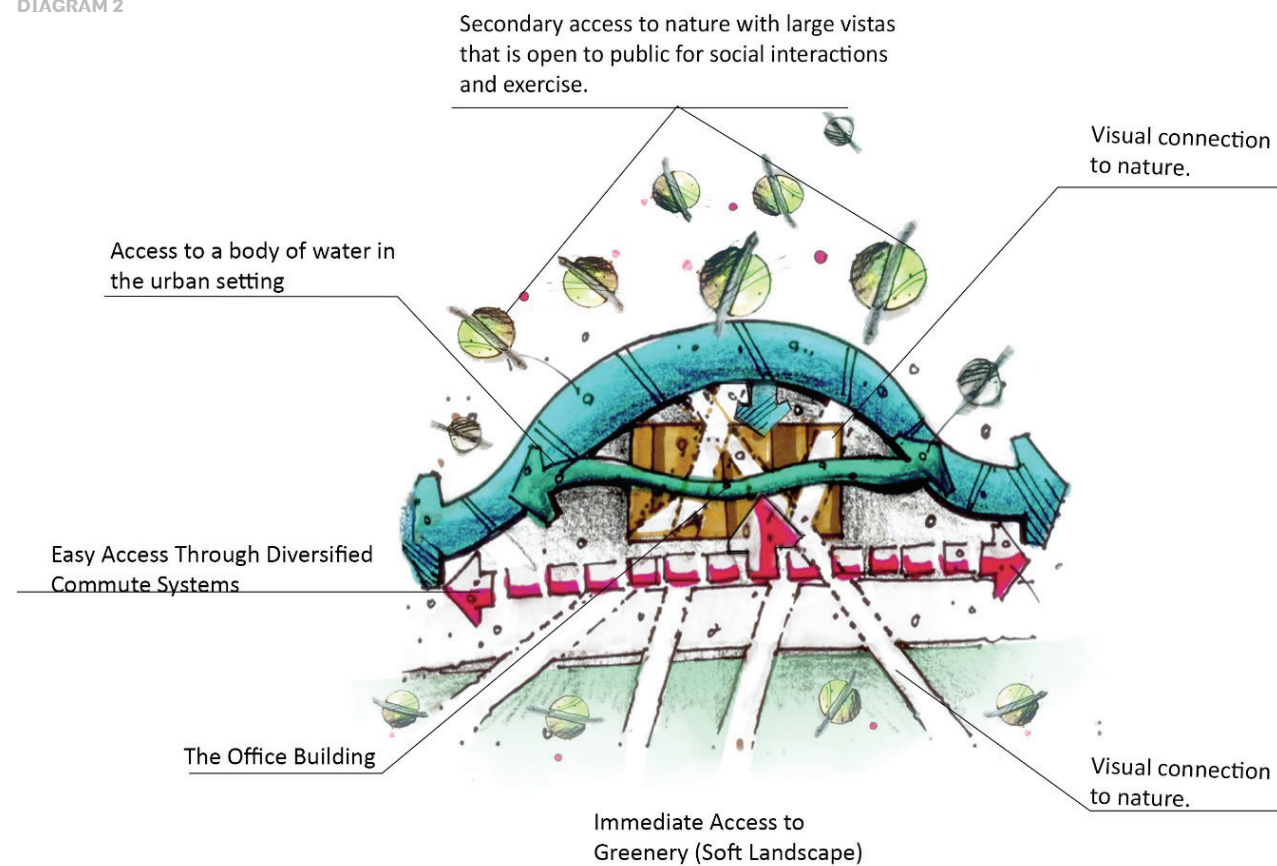


Another problem that causes mental stress for employees can be explained by the prospect-refuge theory, an environmental pattern that is the result of a delicate balance between frame and vista that stimulates a sense of mystery, comfort, and safety (Dosen & Ostwald, 2013). Avoiding enemies, as part of human evolution, is fundamental to this theory, which explains that human preferences are based on the superior response to threats and the apperception of a greater chance of safety (Stamps, 2014). Dosen and Ostwald (2013) identified four main elements of prospect-refuge. The first two, prospect and refuge, are interlocked and must coexist. Prospect is defined as the outlook, vista, or view, while refuge is the setting or context within which a person experiences the prospect (Dosen & Ostwald, 2013). The third factor is the sense that safety may be either real, implicit, imagined, or symbolic; a sense of comfort is the product of the balance between prospect and refuge (Dosen & Ostwald, 2013). The last factor is the complexity of a setting in terms of experimental and visual vibrancy (Dosen & Ostwald, 2013). An environment with restorative (healing) effects has high levels of prospect (open view and clear vision) and high levels of refuge (hiding); by contrast, the environment with a low prospect and high refuge level will increase stress

dense urban settings, such as the downtown areas of large cities, the prospect can be very limited, both inside and outside of buildings. Even plazas in such cities are often surrounded by a cluster of skyscrapers that limit the vista in all directions.

Perceived environmental threats include air, water, and noise pollution; specific urban designs, such as tall buildings, that may be felt to be oppressive; and physical threats, such as accidents and acts of violence (Aronsson, 1989). Avoiding locations with these conditions is the initial step in the process of mitigating occupational stress. The dense urban built environment, without green open spaces or even views of natural elements, threatens the mental health of employees (Beil & Hanes, 2013). The next step in reducing the risk of occupational stress is increasing worker control on the individual as well as the collective level. The structure of control at work is dictated by production techniques, legislation, and management strategies (Gruebner et al., 2017). Although the designer's role in increasing the employee's sense of control is limited, providing various options for commuting and socializing and making available access to nature can improve the sense of control of employees on this scale.

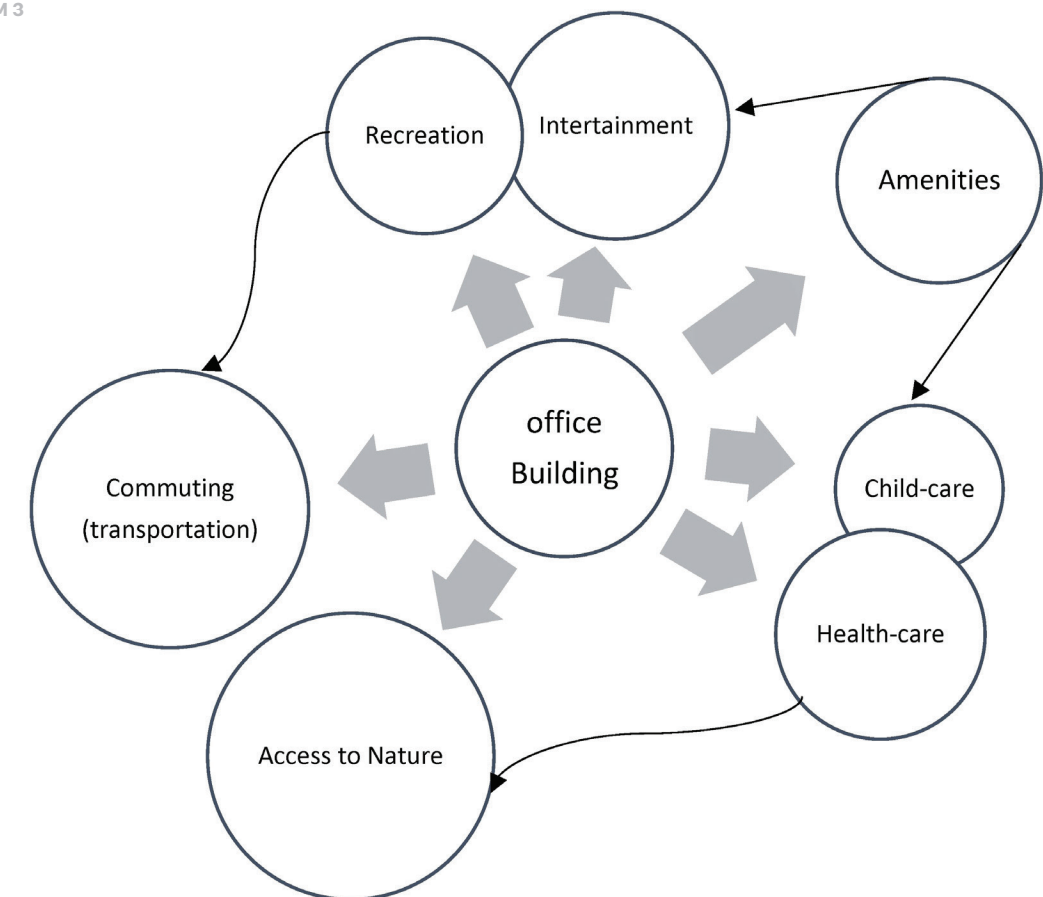
DIAGRAM 2



Providing the connection to nature both visually and physically.

Social isolation is also a reliable predictor of perceived stress (Ward Thompson et al., 2016). A study by Melis and colleagues, for example, found that urban sprawl and the absence of public transportation caused depression due to the fact that people had a lower chance to move around and have an active social life (Melis et al., 2015). By contrast, other recent research shows that social interaction can improve the productivity of the organization. Interaction among employees can take place outside; making available easily accessible green spaces can promote such interaction (Ward Thompson et al., 2016). Although social interaction as an intervention has multiple aspects, the location, entrance, and orientation of the building and adjacent facilities are important factors in its success. A practical strategy for office buildings is providing access to open spaces during breaks (Al Horr et al., 2016). Furthermore, granting easy access to amenities and public infrastructures such as child care, recreational and entertainment spaces, and parks can reduce environmental stressors (Al Horr et al., 2016). (See Diagram 3.)

DIAGRAM 3



Relationships of office buildings in an urban setting with stress-mitigating factors.

Another critical factor that affects workers' stress levels is the level of satisfaction or dissatisfaction they experience during their commutes. However, research on this topic has yielded findings that are inconsistent and even contradictory. Haider, Kerr, and Badmi (2013) found that enduring frequent traffic congestion and experiencing longer-distance commutes increases stress levels. The type of vehicle or mode of transportation that workers use when commuting can also contribute to stress. Also, Gatersleben and Uzzell report that car users feel more stressed than those who depend on public transportation, while those who bike or walk to their workplaces are less stressed (Gatersleben & Uzzell, 2007).

### Conclusion

The significant role of the urban built environment on the mental health of individuals is undeniable; however, mental stress remains a major risk factor usually overlooked in the programming stages of design and site selection. The few urban-planning-related interventions that have been put forth have been limited in both their scope and their quantity, since solutions to the problems they discuss would, in order to be effective, necessarily involve many

other categories of stakeholders and decision-makers than have been consulted up to this point. However, architects, by acknowledging the factors that contribute to workplace-related stress, can provide informed consultations to their clients. Indeed, understanding the conditions that can lead to or exacerbate occupational stress can be crucial when developing master plans for large corporations, their site selection, and the design of their office complexes during the programming phase. (See Diagram 4.)

As discussed above, having access to nature, visually and physically, is one major recommendation for mitigating mental stress in the site selection process. While advocates of biophilia theory have explored these issues extensively, certain aspects of biophilic design remain vague. In biophilic design, “nature” refers primarily to green landscapes—but other types of natural settings, such as those in white landscapes (glaciers, mountains, and water) and black landscapes (lava fields) (Brooke & Williams, 2020) have not been studied to the degree that would allow conclusions to be drawn regarding their effects on mental well-being. For this reason,

I recommend considering sites representing a wider variety of natural settings, especially in light of research showing that different groups of people, with different social determinants of health, do not feel comfortable in the same types of natural environments (Doughty, 2018). For example, densely wooded areas might have healing effects on one group of people (Gatersleben & Andrews, 2013) while causing tension for others (Milligan & Bingley, 2008).

The urban context, the locations of office buildings and adjacent facilities, and their amenities all play a major role in employee satisfaction and well-being (Al Horr et al., 2016). Adjacent facilities, such as those offering services or entertainment, can improve the satisfaction, health, and productivity of employees on various, interconnected levels. However, sometimes, having attractive natural features means that a site may be isolated from other services and far from major urban developments. Thus, finding the right balance between access to nature and the proximity of urban amenities requires a case-by-case study.

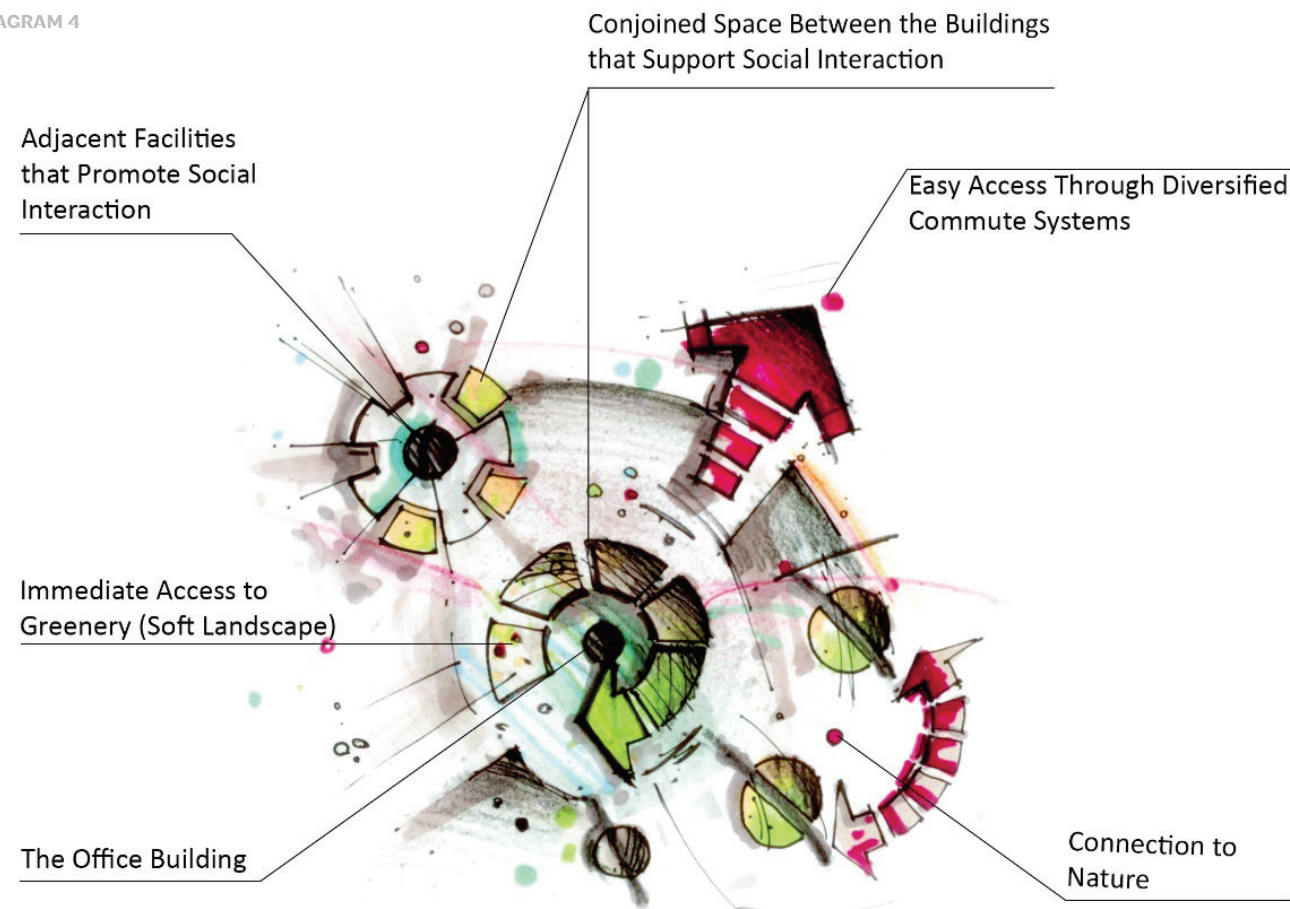
Recent studies show that transportation in the urban environment can further contribute to the experience of mental stress. Being conscious of the impact of transportation type on employees’ mental stress is crucial for decision-makers. Moreover, since studies show that time spent in traffic jams and longer transportation have a direct relationship with mental stress, project directors should choose sites with easy access, low-traffic roads, particularly when developing a site within the urban environment. Moreover, companies that promote walking and biking as transportation options will have less-stressed and healthier employees. Developing such commuting strategies requires a case-by-case study of the employee context, the urban infrastructure, the local context, feasibility, and organizational culture in addition to the the diversity of commuting options.

Finally, social interaction—and the ways that urban planning can enhance such interaction and thus increase employees’ well-being and satisfaction—is also a crucial component that must be borne in mind during the programming phase of the design process. Doing so will necessarily involve a combination of other interventions. Giving workers the freedom to interact with others—and to conduct other essential daily activities—outside of the building can help improve their perceived quality of life. Social isolation can lead to stress and reduce productivity (Ward Thompson et al., 2016); thus, having options for a social life outside the building can reduce these risks. One practical intervention in the urban context is to include public plazas, with amenities and soft landscapes, that are open to the public and that are thoughtfully integrated with the fabric of the surrounding city. This provides an additional opportunity for social interaction outside of the building, among other advantages. However, designing a successful plaza in a dense urban context is challenging, especially when it comes to enhancing physical and mental comfort.

Health care workers are typically and routinely under high levels of occupational stress, including burnout. Such problems are exceedingly common among nurses, medical doctors, and other health care workers and can have adverse effects on their patients as well as on their own organizational outcomes (Clough et al., 2017; Khamisa et al., 2015; Basu, Qayyum, & Mason, 2017). Medical settings, and especially hospitals, are usually the work environments for members of these occupations. Even though such work environments already require specific architectural and occupational stress mitigation strategies, the various urban interventions to mitigate stress discussed in this article apply to health care workers.

Finally, many recommendations concerning the urban context already apply to other best practices recommendations regarding well-being and sustainability, such as LEED and WELL standard guidelines. Thus, the recommendations would fit in the scope of most of the projects. As mentioned above, the existing studies are not conclusive when it comes to mitigation of occupational stress, especially in the urban scale; therefore, it is crucial to have at hand the results of comprehensive experimental research on occupational stress and its relation to the built environment—research that considers architecture, the urban environment, and the conjunction area between them. This research should be categorized based on the various tasks performed by, and the various health detriments to, health care workers. Such research is especially necessary on public spaces and their restorative features, the minimum quantity of open spaces needed in order to be restorative to workers, the impact of different landscape types on occupational stress, and the effects of commutation modes and systems on workers’ mental stress.

DIAGRAM 4



An example of an urban setting that can improve the mental well-being of employees by mitigating occupational stress.



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