



## PHYSICAL IMPACTS OF REMOTE WORK DURING THE COVID-19 PANDEMIC PERIOD.

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### ABSTRACT

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This document brings the results of a research and extension project, "Each one in his square (cube): rethinking the spaces of housing, work and culture in times of pandemic", being the research front to study the impacts brought about by the change in the work (study) -home relationship during the pandemic period, issues related to the health and well-being of the affected population. To this end, parameters such as ergonomics and space functions linked to performance, quality and problems of the actions performed in the home-office were taken into account, in addition, how could the adequacy of the architecture and furniture design modify these issues. To obtain the necessary information, bibliographic reviews and interviews were carried out. Through the research, it was possible to suppose that changes in the physical space and in the way the tasks are performed, together with the advice of professionals in the area, such as architects and physiotherapists, can help to reduce the negative impacts of the new work and/or study model introduced even before the period of the pandemic, and after it, accelerated and intensified.

**KEYWORDS:** *Home Office*, COVID-19, Ergonomics and Impacts.

### 1. INTRODUCTION

The COVID-19 pandemic, which began in China in late 2019, has brought about various changes in society, in the ways we act, relate, study, and work. In relation to the last two factors, due to the imposition of telecommuting and remote learning, there has been a significant shift in the relationship between housing and work/study, bringing some benefits, such as, for example, less time spent commuting to work, greater potential for autonomy, and from the perspective of employers, reduced expenses related to physical workspaces. However, one may ask what negative impacts have been brought about by this change in environments and relationships.

The research aims to identify such impacts, especially the negative ones, brought about by the alteration of the work-housing relationship, considering higher education as a form of work during the pandemic period, and raise questions related to the health and well-being of

the affected population. Taking into account parameters such as ergonomics and the functions of the space linked to performance and the quality of actions carried out there. Furthermore, how could architectural adjustments modify these issues.

The target population consisted of workers and higher education students who were affected by the forced transition to telecommuting and remote learning during the spread of the COVID-19 pandemic. To achieve this, bibliographic research was conducted using data from institutions such as the Brazilian Institute of Geography and Statistics (IBGE), the Institute of Applied Economic Research (IPEA), and the General Register of Employed and Unemployed (CAGED). Additionally, in March 2021, an interview was conducted with two employees of a facilities management company that provides services to a large multinational online and software company based in the United States. This interview aimed to understand how the management of this change in environments was carried out in such a large, international company with more abundant resources. The goal was to explore whether this company, being aspirational, could serve as a model or be adapted to the circumstances and locations of small and medium-sized Brazilian companies.

## **2. DEVELOPMENT**

### **2.1 SOCIOECONOMIC PROFILE:**

According to IPEA (2020), in 2020, remote work (Home Office) could account for up to 22.5% of occupations in Brazil. Women were the majority who adopted remote work during the COVID-19 pandemic quarantine, comprising 57% of the total. Regarding race/ethnicity and educational level, 65.4% of white individuals and 76.1% with a higher education level engaged in remote work. In terms of age, 31.6% were between 30 and 39 years old, and 84.1% were in the informal sector. In economic classes, the A/B class was the most prominent in telecommuting, representing 52% (C6 Bank/Datafolha, 2020).

The high percentage of women in remote work also brings to light an issue that has been discussed, which is the continued responsibility for caregiving tasks that are often seen as the duty of women, such as household chores and childcare in many Brazilian households. This is compounded by the fact that women are often the primary or sole breadwinners of the family. All of this results in women having a second or third shift of work. During the pandemic period, when some of these women had to manage these tasks while maintaining their economic work activities, it may have brought more significant impacts than the rest of the population. Part of this impact was measured by the Parent in Science group (2020), which showed that the intersection of gender, race, and caregiving responsibilities (such as children) had a significant impact, particularly on the publication of academic research by women in the scientific community, leading to the conclusion that...

"Especially for article submissions, Black women (with or without children) and white women with children (especially those aged up to 12 years) were the groups whose academic productivity was most affected by the pandemic. The academic productivity of men, especially those without children, was the least affected by the pandemic." (PARENT IN SCIENCE, p. 12, 2020.)

On the other hand, researchers Abreu, Marques, and Diniz (2020) depict the reality of women dealing with basic jobs, freelance work, and others, who experienced a significant increase in their household workload due to the lack of division of labor. Furthermore, their research highlights that women make up the majority in professions within the healthcare sector, putting them at a higher risk of contracting COVID-19. Additionally, one of the roles often assigned to women is that of caregiving, which involves taking care of sick individuals, the elderly, and children. During the pandemic, this responsibility increased significantly, as

the virus itself led to more people falling ill. As stated, "women, when they are not part of high-risk groups, are part of caregiving groups, and therefore, this period is particularly critical for them" (ABREU, MARQUES, AND DINIZ, p. 6, 2020). Another issue is the care of children, who during this period could not receive the assistance of daycares and schools, placing an additional responsibility on women to juggle.

The researchers also point out that this increased difficulty in domestic tasks varies according to social class and race, as "the poorer the families, the greater the amount of unpaid work to be performed (without dishwashers, without washing machines ...etc.), compounded by the lack of resources to hire another woman to perform some of their tasks" (ABREU, MARQUES, AND DINIZ, p. 6, 2020).

According to UN Women (2020), in addition to the impacts caused by the uneven distribution of household tasks, women are also disproportionately affected by unemployment during periods of economic crisis, such as the one brought on by the COVID-19 pandemic. It's important to note that one significant avenue of informal employment for women is domestic work, which is another sector that has been heavily impacted by the virus.

Furthermore, there is a segment of the population, such as women who are both teachers and mothers, whose lives have undergone significant changes due to the "new normal." As a result of this shift in the work-home relationship and their primary responsibility for caring for children and/or dependent individuals at home, it has become apparent that the pandemic and remote learning have led to an increase in the workload for this group. This overall increase in working hours for these women has resulted in significant health problems, particularly in terms of mental health. This has led to cases such as Burnout Syndrome, characterized by a loss of motivation and meaning in one's work, resulting in a lack of enthusiasm and purpose in performing it (Jaskiw; Lopes, 2020).

Therefore, the new relationship of balancing work, which was previously conducted outside the home, with activities already carried out within households, must take into account the multiplicity of roles that women undertake. These roles were well-established even before the pandemic and have continued as the new form of work. This discussion should take center stage in society so that these injustices become clearly evident, and measures can be taken to address them.

Furthermore, we have identified the types of jobs that have undergone the most significant changes to adapt to the home office model, as illustrated in Tables 1 and 2. It's important to note that some fields are better suited to remote work than others.

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<sup>1</sup> The Parent in Science aims to initiate a discussion about motherhood and fatherhood within the field of science in Brazil. It was created in 2005 and is composed of 15 mothers and 1 father, who, in addition to this activity, are researchers and professors.

<sup>2</sup> "Facility Management: 'an organizational function that integrates people, spaces, and processes within a built environment with the goal of improving the quality of life for people and the productivity of the core business' (ABNT, 201-)

Table 1: Impact of the home office on the types of work

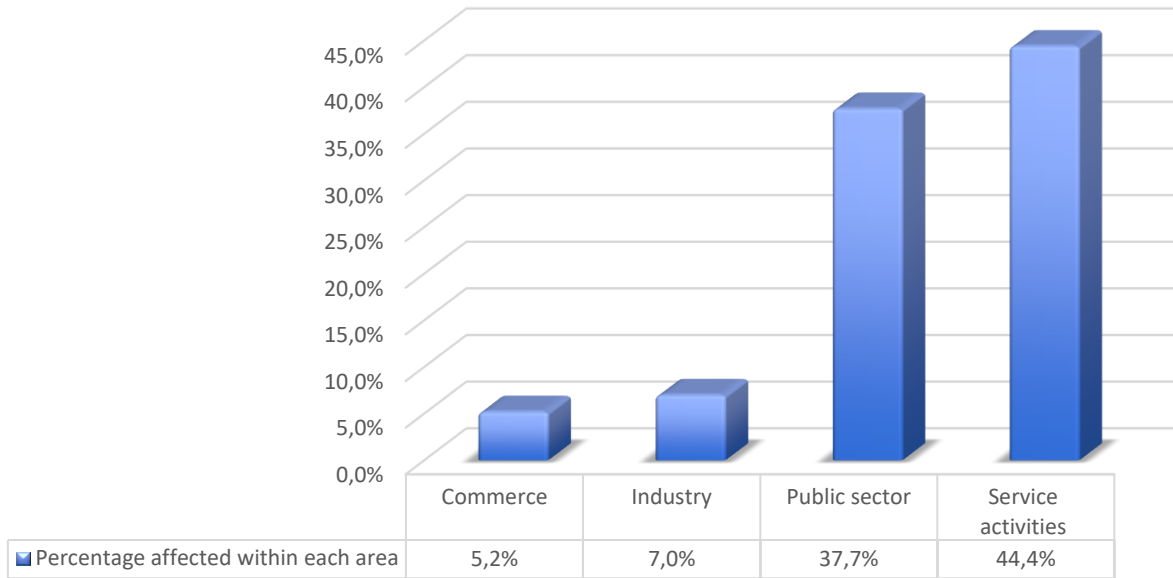
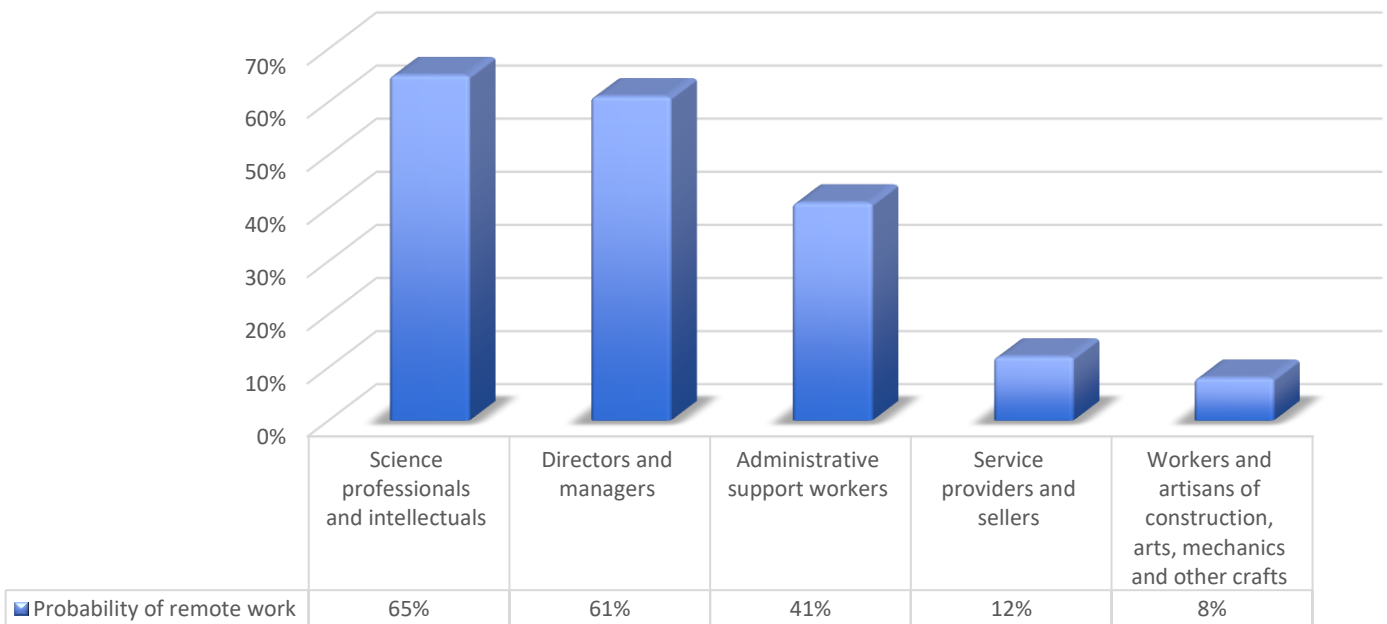


Table 2: Types of jobs that most tend to the home office



## 2.2 THE HOME AS A WORKPLACE

The Brazilian society holds prerequisites in terms of housing to meet these changes? As advocated by Mendonça (2010), the concept of housing as we know it today has undergone significant transformations over the years. In ancient civilizations, it was common for work and living environments to be shared, something that the population is now needing to relearn how to reconcile. However, as discussed, these changes are happening too rapidly, so there is not a focus on creating dedicated spaces for work and study within residences. Instead, it involves adapting existing spaces, allowing for the performance of multiple tasks within the same area. This is particularly challenging in large metropolises where space is increasingly limited, making it inevitable that multiple tasks must be carried out in the same space.

As demonstrated in their case study research on new developments in the city of São Paulo, Brazil, between 2006 and 2009, there was already a concern for the adaptation of new architectural plans in 22% of the developments. However, the quality of the space provided was often limited to the minimum necessary dimensions (Mendonça, 2010).

In the research conducted by Archademy in 2021 (Zanatta, 2021), it demonstrates that the demand for optimizing homes to accommodate home offices, either due to the increased time spent at home during the COVID-19 pandemic, significantly increased. It was found that "85% of the 650 surveyed offices generated proposals during the period of social isolation. Among them, 50.5% involved adapting spaces for home offices" (Zanatta, P.1, 2021).

Regarding subjective psychological well-being, external factors to remote work can indeed influence this relationship and outcomes. A study conducted by Lizote et al. (2020) among undergraduate students, who are close to entering the professional world, yielded results indicating that there is a perception of well-being deficits, as on average, the perception of negative emotions is higher than that of positive emotions (Lizote, P. 262, 2020). Furthermore, it was also observed that the less activities are related to intrinsic and autonomous reasons, the higher the incidence of perceiving negative emotions (Lizote, P. 261, 2020).

## 2.3 NEGATIVE IMPACTS OBSERVED IN THE NEW HOME-WORK RELATIONSHIPS

According to research conducted by the Getulio Vargas Foundation (FGV) in partnership with the Institute of Employment Studies (IES) in the United Kingdom, and with technical support from Sharecare, the imposed mode of working from home due to the COVID-19 pandemic has had various impacts on the lives of workers, both physical and psychological. Focusing on the physical impacts in this document, the research shows that the most frequent complaints among the people surveyed include "back pain (58%), neck pain (75%), eye fatigue (55%), sleep loss (55%), and headaches (53%)" (Bori; p.1, 2020). Additionally, 63% reported that they are not exercising in the same way and frequency as before the virus circulated, and 46% are having difficulty setting working hours, resulting in an increase in workload and irregular working hours. These impacts are primarily attributed to the lack of a suitable environment with proper furniture and comfort indices in relation to the body. In the psychological aspect, stress and the pandemic situation, along with pre-existing conditions, may have contributed to these issues in individuals.

According to a 2021 study conducted in Germany, home workplaces are similar to office environments that use computer equipment, such as computers. Therefore, their problems and

solutions are based on the same set of guidelines. Some key factors to consider for greater comfort include adequate lighting at workstations (with specific lighting requirements for different types of work, as outlined in Brazilian standards like NBR 5413, which deals with interior illuminance). Another important factor is the room's temperature, which should be suitable for optimal worker performance (Mojtahedzadeh, et al., 2021).

The issue of working hours should also be taken into account, as in this mode of work, there is a greater challenge in setting limits on working hours and preventing interruptions. This can lead to an increase in working hours, which, in turn, may result in a higher error rate, decreased productivity, and increased stress. Additionally, the difficulty in disconnecting from work-related matters due to the home environment can be problematic. This difficulty in separating work from personal life can lead to exhaustion and sleep problems as workers struggle to stop thinking about work-related issues even after work hours (Mojtahedzadeh, et al., 2021).

Considering the similarities with the previously mentioned workplaces, a research project aimed at highlighting the impacts of work in the financial sector also revealed relevant points related to telecommuting, especially the impacts related to Work-Related Musculoskeletal Disorders (WRMSDs). These results are attributed to furniture and tools that do not properly accommodate the work being done, such as chairs with improper adjustments, monitor heights, or the use of mobile devices with incorrect posture. The lack of support on the desk for documents and similar items increases the need for rotation and flexion. Additionally, the absence of proper foot support or the improper use of items like armrests that prevent the correct trunk posture in relation to the desk can contribute to WRMSDs. Another issue is the positioning of tools, such as monitors placed facing sources of light, which can make reading difficult and force workers into an uncomfortable posture (Ferreira, Shimano, & Fonseca, 2009).

On the other hand, it is essential to understand what measures could help reduce the impacts caused by remote work, as demonstrated in a study conducted by Tanoue et al. (2016). The study showed that the use of a more suitable chair can prevent future lumbar and pelvic problems and also influence fatigue and work performance. The research examined two "sitting types": one with a static chair that does not allow for movement and another with a more dynamic chair that allows for more frequent movements. Through the analysis of these two types, it was deduced that the use of a dynamic chair helps reduce fatigue and physical problems, making sitting work less impactful during the workday.

Furthermore, studies conducted by Jan Dul and Bernard Weerdmeester (2012) suggest that alternating between sitting and standing while working or studying can help eliminate prolonged postures that are harmful due to extended tension. Therefore, if possible, workstations should be designed to accommodate both sitting and standing positions. Additionally, incorporating regular exercise and taking breaks during the workday is also recommended to promote physical well-being.

Indeed, individuals who work remotely without proper guidance on how to use electronic equipment can experience eye fatigue due to prolonged screen exposure and improper angles and distances, which can lead to other problems such as headaches caused by eye fatigue. According to researchers Coles-Brennan, Sulley, and Young (2019), ergonomics of digital devices can help mitigate these impacts. This includes proper lighting, careful positioning, image parameter adjustments, and breaks. Regarding the last point, the 20/20/20 rule can be particularly helpful. This rule involves taking a 20-second break to look at an object or scenery that is at least 20 feet (approximately 6 meters) away every 20 minutes of using a digital device (See Figure 1)



Figure 1: Illustration of the 20/20/20 Eye Rest Method. Source:

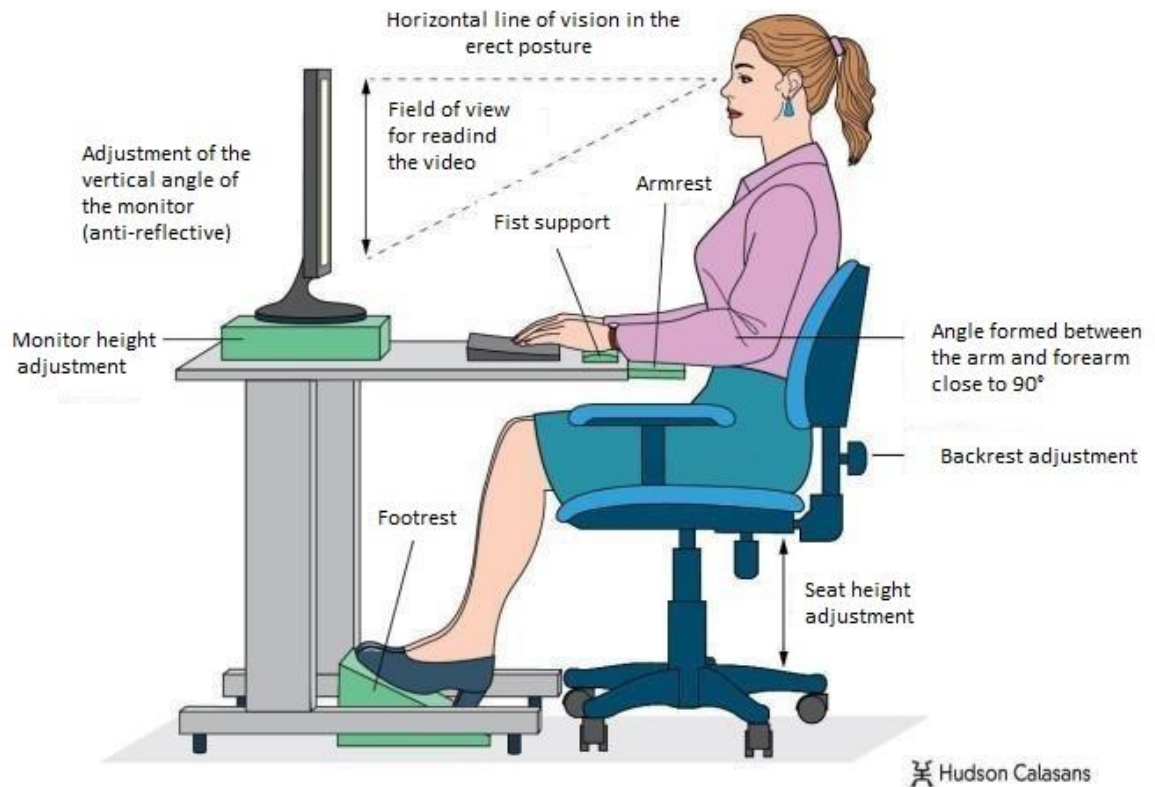
<https://www.juststand.org/blog/prevent-eye-strain-with-the-20-20-20-rule/>. Accessed on June 29, 2021.

Furthermore, in Brazil, there is the NR 17 standard that deals with ergonomics, applied by Ministerial Order No. 3,214 of June 8, 1978, establishing some necessary parameters for ergonomics within work environments. One of the foundations of this document relates to the overall environmental comfort of a workplace. It specifies that noise levels in the environment should comply with the Brazilian standard registered with INMETRO, NBR 10125. Additionally, it states that the effective temperature should not exceed 23°C or be lower than 20°C, with relative humidity below 40%, and air velocity less than 0.75m/s. Furthermore, adequate lighting for the activity performed is required.

On the other hand, these measures, within conventional workstations, were already challenging to implement and enforce. When transitioning to telecommuting, a proposal made hastily and without thorough planning and foundations, there is a significant possibility that most residences do not meet these parameters. Likewise, companies may struggle to provide the necessary support for adapting to telecommuting or home offices.

In relation to the ergonomics of furniture and work tools, NR 17 provides the following parameters for a better adaptation of the work environment. The computer monitor should have the correct angle and height adjustment, as there is an exact height for each individual that should be adjusted so that the monitor is at eye level, in order to prevent eye fatigue and back problems. Similarly, the keyboard and mouse should be positioned so that the arms do not have an angle different from 90 degrees with the body, and there is also a need for this furniture to be adjustable so that each person can make the necessary adjustments (See Figure 2).

Regarding the desk furniture, it should have space not only to accommodate electronic devices but also to provide room for document support and other items necessary for the specific work. The minimum depth should be 75 centimeters if there are no reference materials and 90 centimeters with the materials present. As for the chair, it should also have an ergonomic design to support the lower back, and there should be no conformity of the seat base. If these measurements are not sufficient for a person to reach the ground with their feet correctly, a support apparatus is necessary for this purpose (See Figure 2).



*Figure 2: Diagram illustrating how furniture should adjust to the body to reduce impacts.*  
 Source: <https://riosassuncao.com.br/2020/04/22/ergonomia-e-home-office/>. Accessed on June 29, 2021.

Another factor that can contribute to reducing the impact of repetitive work and poor posture due to inadequate furniture for performing tasks is Occupational Gymnastics. This involves exercises that typically take 5 to 15 minutes, aimed at preventing injuries such as Repetitive Strain Injuries (RSI) and Work-Related Musculoskeletal Disorders (WRMSDs), as well as reducing stress through stretching and relaxation exercises.

This type of practice can be divided into three sectors. The first is preparatory gymnastics, which is done before the workday begins, involving stretching to focus the mind and disconnect from external distractions. The second is compensatory gymnastics, which allows the muscles that are most used during work to relax, while engaging others in exercises. The third type is relaxing gymnastics, performed at the end of the workday through relaxation techniques to release tension in muscles that were heavily used during the day. Similar to the preparatory gymnastics, its goal is to disconnect from the tasks performed during the day to transition to the next stage. These elements are of utmost importance when working remotely, especially the preparatory and relaxing aspects, as they create boundaries through exercises that better separate each moment and type of work during the day (LIMA; NOGUEIRA, 2017).



## **2.4 ADAPTATION OF WORKSPACES BY COMPANIES/ISNTITUTIONS**

According to Law No. 13,467, dated July 13, 2017, which amends the Consolidation of Labor Laws (CLT), approved by Decree-Law No. 5,452, dated May 1, 1943, as well as Laws No. 6,019, dated January 3, 1974, 8,036, dated May 11, 1990, and 8,212, dated July 24, 1991, in order to adapt legislation to new labor relations, it introduces the regime of Telework in Articles 75-A to Article 75-E. These articles describe that remote work can be legally performed, provided it is done by mutual agreement between the parties, as stipulated in the employment contract. Additionally, it is stipulated that the provision of minimum equipment necessary for carrying out tasks by the employee is the responsibility of the employer, and these provisions should be outlined in the contract. The employer is also required to provide instructions to employees regarding the prevention of occupational diseases and accidents.

On the other hand, this framework for labor rights takes into account remote workers who are formally registered under this modality. However, the sudden shift to telework due to the COVID-19 pandemic occurred without prior planning, leaving workers with limited ability to demand even the minimum protections provided by this law. It should be noted that the existing laws are vague on various aspects of remote work.

For example, Article 75-D, which pertains to the provision of work tools, leaves it up to the employer-employee relationship to define what is essential. Therefore, items related to adequate ergonomics, such as a comfortable chair and desk of appropriate height and materials, may be considered non-essential, even though they can lead to future health problems for workers, including back issues, vision problems, or psychological stress. There is no legal requirement for employers to provide a foundation for remote workers to handle the new relationship between their home and daily activities and formal work in a healthy manner.

Another point where legislation could address concerns is related to the necessary breaks during the workday to avoid issues such as muscular fatigue in the case of repetitive tasks or eye strain due to prolonged exposure to electronic devices, such as computers. To address this, it would be necessary to involve a team of professionals, including medical specialists, physiotherapists, etc., to determine the most appropriate break intervals during the use of the home office method. These intervals could also incorporate practices like occupational gymnastics, which have been seen as a good option for reducing the physical and psychological impacts of uninterrupted work.

In addition to the previous point, another essential concern is the mental health of employees. Therefore, there should be provisions within the law that can ensure this kind of support for workers by companies. For example, in companies with a larger workforce, there could be access to professionals like psychologists, or when offering healthcare plans, companies could check if these plans cover mental health services.

## **2.5 ASPIRATIONAL COMPANY**

The research conducted an interview in March 2021 with two employees of a facilities management company that provides services to a large multinational online and software services company based in the United States. This multinational company hosts and develops a range of internet-based services and products and has a presence in several Brazilian cities. The interview aimed to understand how a large company like this responded to the shift to

remote work during the COVID-19 pandemic. It's important to note that the abundance of resources in a company of this size differs from smaller companies, but it can still serve as a reference point.

Another point of consideration is that the company receiving the facilities services is known for its welcoming work environment, which offers various amenities such as beauty care, healthcare, food, and more. Therefore, the shift to remote work also impacted the culture of the workplace. This workplace culture is designed to attract and retain talent, especially in a highly competitive industry. As a result, the physical workplace plays a significant role in recruiting individuals, and remote work was only allowed to reduce distances between branches.

As mentioned by the interviewees, the multinational company in question was, to the extent possible, already prepared for the arrival of the virus due to its global presence, which had led to the development of procedures for such situations. Some of the ideas and practices from other locations were adapted and applied to respond to the pandemic.

Furthermore, it's worth noting that the company had previously implemented a program focused specifically on ergonomics within the workspace. This demonstrated a prior concern for the impact of furniture on the body. Examples of this included the use of adjustable height desks and chairs, allowing each individual to set up their workspace in a way that ensured their arms formed 90-degree angles and their heads remained in line with monitors or had a clear view of work-related materials without the need for abrupt changes in posture.

With the onset of the pandemic and the transition to working from home, the company continued its ergonomic program. They adapted it by offering online consultations and guidance on setting up workspaces and furniture within employees' homes. This allowed employees to seek advice on ergonomics and address any concerns related to their home office setups.

Initially, the company allowed employees to take company-provided furniture home to set up their remote workspaces. However, as time went on, concerns arose about the small gatherings that occurred during these furniture transfers, potentially contributing to the spread of the virus. Consequently, the company decided to discontinue this practice and instead provided employees with vouchers or a monetary allowance. This allowed employees to purchase the necessary equipment, such as chairs and desks that were more suitable for their needs, thereby creating a more comfortable and ergonomically friendly home office environment with fewer potential negative impacts.

Another point was the company's concern for employees' health, encompassing not only physical health but also mental well-being. They have programs that assist individuals in maintaining their focus on work while also allowing them to take breaks and engage in non-work-related exercises. Additionally, they provide the necessary support for mental health issues, including offerings such as yoga classes, stretching sessions, and workplace fitness activities.

However, it is well-known that such a company has resources that deviate from the standard for small and medium-sized Brazilian businesses, as they lack the same level of support due to budget constraints or applied and studied knowledge tailored to each business. Therefore, this example serves as an aspirational company, and understanding what happens with large companies can help identify what can be adjusted for others, albeit on a smaller scale and with different numbers.

Companies with fewer resources can still provide support in terms of knowledge for their employees. They can create newsletters to showcase measures that can be used to reduce impacts, such as recommending suitable furniture and explaining the reasons for separating activities within the same workspace. Additionally, they can suggest publicly accessible online channels that offer activities like yoga, workplace exercises, and similar options, in case they are unable to afford a fitness professional or physiotherapy. It's essential not to forget about mental health care, which is also of great importance.

### **3. CONCLUSIONS**

The COVID-19 pandemic has brought various changes to the daily lives of people around the world, one of which is the acceleration and increase in the shift from the traditional workplace and study environments to working from home or telecommuting. Alongside this transformation, it was possible to observe both positive and negative impacts. Positive impacts included reduced commuting time to the workplace and increased individual autonomy. On the other hand, there were also negative impacts resulting from the interactions in the new work environment and the activities performed. These negative impacts included physical issues such as headaches, lower back pain, repetitive strain injuries (RSI), and eye strain. Additionally, psychological challenges emerged, such as increased stress, difficulty in setting boundaries, and related syndromes.

As initially proposed, this work focused more on the negative physical impacts caused by these changes, influenced by issues related to ergonomics, the proper separation of spaces and tasks, and guidelines on how to navigate this "new normal." It also aimed to assess which groups were affected and their relevance within the city.

As a result, it can be confirmed that a significant portion of the population that transitioned to remote work and/or study experienced impacts on their lives and living conditions. It was also noted that not all social classes, social groups, and genders were affected in the same way. Therefore, it would be inappropriate to assess the impacts and how to minimize them without first understanding the pre-existing social differences that were exacerbated during this pandemic period. It is clear that, alongside the process of adapting to new work setups, there is a need to continue and create projects that address the individual needs of these less visible and more disadvantaged social groups.

Through this research, it was observed that ergonomic furniture parameters and the use of break and focus mechanisms can help alleviate the negative impacts affecting Brazilian workers. Some examples mentioned in this article include the use of chairs and desks with adjustable heights tailored to each individual's body, company programs that assist employees in maintaining a suitable pace and separating various activities within the same environment, and whenever possible, guidance from professionals in each field to accommodate these changes. This includes physical education and physiotherapy professionals for activities involving the human body and input from architects and urban planners to adapt the environments where work and study activities take place.

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