Thematic Section - Production Engineering leading the Digital Transformation

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Analysis of the work quality and productivity during the COVID-19 pandemic

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Abstract

Paper aims: This paper analyzes the work quality and productivity of during the COVID-19 pandemic from five Brazilian regions with three work models: face-to-face, virtual and workshiting.

Originality: Despite the number of studies on COVID-19 since the pandemic's beginning, the literature lacks research that demonstrates relationships between productivity and the emergence of problems, illnesses, and adverse situations that compromise worker performance in the routines of these three work models.

Research method: The study used an experimental, descriptive, and transversal research design, without identification data Southeast of the participant, as anonymous and exclusive research, with 801 participants from different regions of Brazil (North, Northeast, Midwest, Northeast, and South), with different age groups. The work consisted of work issues focusing on the quality of work pandemic, for issues of analysis of time and productivity problems. The questions were about health issues in 6 parts of the study: mental demographics and increased sleep quality, fear of SARS-CoV-2, exercise, stress, and productivity.

Main findings: There was a strong significant relationship between the three work models and five variables: area of activity, work equipment used during quarantine, diseases found during the pandemic, problems reported during quarantine pandemic like sleep, stress, workload performed, and future expectations regarding the work performed and the pandemic. Significant relationships were also found with diseases before the pandemic, those perceived and reported during the pandemic period studied, and the sleep profile before and during. The statistical significance relationship was also strong between the areas of work audience and new diseases during the pandemic.

Implications for theory and practice: The research practically validates several other theoretical studies, with guidelines for the scientific community on work behavior for the three work models. The results, together with the relationships found by the statistical analysis of the p-value of the variables, help the public and private authorities to understand and rethink preventive measures in the emergence of new diseases and the optimization of work operations without compromising their quality and productivity.

Keywords
COVID-19. Home office. Face-to-face. Productivity. Quality of work. Workshifting.

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spread rapidly across multiple countries in early 2020 (Gudbjartsson et al., 2020). To reduce the transmission of coronavirus 2, an estimated 4·5 billion people globally have been placed under lockdown restriction. Modeling and early empirical investigations indicate that

physical distancing measures are crucial to reducing transmission of the virus, consequent pressure on health systems, and the number of deaths (Drake et al., 2020).

In addition to the millions of people infected by coronavirus 2, hundreds of thousands have died—and will die—from COVID-19. An anticipated wave of mental and behavioral problems is beginning to be documented—compounded by social and economic stressors and uncertainties—that will likely present a population health burden for months and years (Galea, 2020). Isolation can bring unpredictable consequences, with potential illnesses and domestic, mental, and work problems. Working in quarantine can be a challenge for several reasons. The new home office work models, even the face-to-face model with all the sanitary protocols and the hybrid models, diversify how work can be done. However, bodily and mental injuries and various problems can occur in these adaptations. A government agency recognized the term injures inaccurate and misleading, and the term work-related upper limb disorder was suggested as an alternative (Cucinotta & Vanelli, 2020). Physicians have a crucial role in the early recognition of these disorders and in stimulating appropriate ergonomic interventions to reduce their frequency and severity (Chamola et al., 2020). In addition to clinical care (injuries, pains, inadequate working postures, and mental health demands), people had to face the obligation to exercise their role as instruments of the means of production. Factors such as being in contact with the virus or fear of contagion in the workplace triggered more significant symptoms (Santamaría et al., 2021).

Working during the pandemic has become one of the main challenges of modern history, as there is exposure to new virus workers and the behavior of their productivity is felt from the financial results of companies to the emergence of new diseases at work. Among the general global population, relatively high rates of depressive symptoms, from 14.6% to 48.3%, and anxiety symptoms, from 6.33% to 50.9% were reported during the COVID-19 pandemic (Xiong et al., 2020; Luo et al., 2020; Wang et al., 2020). Pressure for results, and psychological stress, there are several fields of study that engineering can act to reduce ergonomic and socioeconomic impacts. Occupational exposures are associated with physical health problems such as cardiovascular disease, metabolic disorders, obesity, and musculoskeletal and gastrointestinal diseases (Cendales et al., 2014).

The COVID-19 pandemic, in addition to being effectively the greatest threat to global public health of the century, can be considered a deficiency agent in the economic, political, and social advancement of the affected countries (Chakraborty & Maity, 2020; Cordova et al., 2021). The outbreak of these types of infectious diseases has generated a global tragedy not only for human lives, but also with impacts on economic activities such as manufacturing operations, supply chain and logistics, and several other sectors (Golan et al., 2020; Haren & Simchi-Levi, 2020). The most relevant impacts on the means of production and services extend to all sectors of the economy, in their entirety of sectors and social and economic agents involved in production methods. The first victims were the transport and hospitality industries then companies in several segments were hit hard with lost revenue, reduced demand, broken supply chains, and damage to entire chains causing a drop in the level of confidence of companies and consumers and one of the main commercial disorders in recent decades (Assunção et al., 2020). The COVID-19 pandemic has severely impacted several sectors, including the automotive sector, tourism, aviation, oil, construction, food, health, and others (Chamola et al., 2020). It is necessary for organizations to have a broader vision, establish a larger network, be prepared for ruptures, invest more, correcting flaws, whether structural, tax, or other that may compromise their activity (Backes et al., 2020).

Obtaining a database to understand the behavior of some variables can help in decision-making by the government, companies, and the worker himself, whether in adapting his new job to the directions of his routines. In studies of workplace stressors, the increased frequency of distress found in a population can be interpreted as related to COVID-19, although more studies are needed to confirm this association (Brooks et al., 2020). One of the objectives of this article is to analyze the pandemic of the new coronavirus to elucidate the behavior of productivity perceived by workers and the emergence of restrictions that impact the quality of work through a survey defined with different variables.

2. Materials and methods

2.1. Participants

The study used an experimental, descriptive, and cross-sectional research design. The study was conducted as an anonymous survey, without requesting identifying details from subjects such as name, email address, or telephone number. Data were collected through an electronic survey questionnaire, prepared using Google Forms. Participants were invited to publicize these questionnaires through their contacts and later share them on their profiles. It was made clear that participation is voluntary, and the participant can withdraw at any time without any consequences. The process continued until the required sample size was completed. Those

who agreed to participate completed the survey questionnaire by clicking on the link provided in the survey form. Eight hundred and one participants from various regions of Brazil (North, Northeast, Midwest, Southeast, and South) with different age groups. All participants were volunteers to answer the survey. The research was applied between the months of April to June 2020 and the analyzes were carried out between the months of July to December of the same year.

2.2. Instruments

The questionnaire consisted of 24 questions about the quality of your work in times of a pandemic, with different types of answers adapted from the Likert scale (five points) or options scale to allow more information on the questions and correlate certain types of data that we consider useful for the development of research analysis. The questionnaire was applied in Portuguese, self-administered, and online, available on social networks and messaging apps, with links sent to groups and individual messages. The 24 variables defined for modeling based on the survey were planned with a focus on the work environment and productivity. The questions were divided into 6 parts of the study: demography of the participants, such as age and region of residence, methods, and work models, focused on productivity profiles, Patient Health Questionnaire 4 (PHQ-4 scale) adapted for profiles of illnesses and other problems of the respondents, Coronavirus-19 Fear Scale (FCV-19S) for a better understanding of the quality of the environment, structure, and work methods with the interference of the perspective of the COVID-19 pandemic, Quality Scale of Sleep (SQS) adapted for the identification of sleep profiles and Anthropometry, for the identification of the causes of illnesses based on the work instruments and the worker's height (Shirali et al., 2018).

2.2.1. Demography

Sociodemographic characteristics necessary to obtain correlations with sleep quality variables were asked. The age was also asked and categorized in the questionnaire with ages from 14 to 15 years old (classified as a minor apprentice), 16 to 17 years old (intern, minor apprentice, or scholarship holder), in addition to the classification with the highest working age, with categories from 18 to 19 years old (intern, minor apprentice or scholarship holders), 20 to 29 years old, 30 to 39 years old, 40 to 49 years old and 50 years old or more. The region of residence was classified as a geographic region widely used as sociodemographic study variables in surveys in Brazil (North, Northeast, Midwest, Southeast, and South), following the standards of the Ministry of Health. For the area of activity, several types of work areas were asked and categorized by large areas for further analysis.

2.2.2. Mental health and increased consumption

Participants were asked questions about mental health objectively and in a representative way of problems that arose during the pandemic. The main question related to the main occurrences during the pandemic period that are directly related to mental health (place reference), such as bad mood, mood change, insomnia, headache, high stress, anxiety attacks, and constant discouragement. More questions related to treatment and the search for specialized help were inserted for the emergence of these problems and the increase of various items due to the pandemic in general. Among these are alcohol, psychoactive substances, coffee, high sugar intakes, increased consumption of fast food, and healthy items, such as water and fitness food.

2.2.3. Sleep

For sleep latency and quality, two profiles of participants were asked, before and during the pandemic. The adapted Likert scale was used, targeting sleep regularity and continuity, with yes for maximum regularity and continuity and no for the minimum. There was one of the answers used in the questionnaire of mental health to analyze statistical relationships. Insomnia is one of the characteristics of sleep disturbance (place reference) concomitantly with mental health.

2.2.4. Fear of Sars-CoV-2

The fear of COVID-19 was assessed in an adapted way with the Fear of Coronavirus-19 (FCV-19S) scale, the Portuguese version (from Brazil), which is called the Fear of Covid-19 Scale (EMC-19) (insert reference).

It is a self-completion questionnaire composed of some items to be answered on a 4-point Likert scale, from "not very confident" to "very confident". The main related issues were the safety of the work environment for non-contamination by COVID-19 and future expectations for improving the pandemic in work routines.

2.2.5. Ergometric illnesses

They were asked through self-report and not diagnoses if people had developed any exercise-related illness associated with the work environment. There was a question related to before the pandemic to carry out a comparison of before and during. Among the diseases, orthopedic, muscular, bone, and psychological were listed in the questionnaires.

2.2.6. Productivity

Respondents were asked perception questions about individual productivity and its external interference, whether by the company itself, the work model, the area profile, the instruments used, or the workload performed compared to the planned workload. The frustrations of non-execution of activities and their interruptions were also asked. The questions related to the worker's perception were composed by a Likert scale model from 4 to 6 points. The others were absolute descriptions, such as the type of equipment used or the planned or executed workload.

2.3. Statistical analysis

Statistical analysis was conducted to assess the quality of work, considering some medical and ergonomic variables. The data were tested for assumptions that should be met using a correlation test between paired questions. This means that the medical and ergonomic variables should be statistically significant, with a correlation between the investigated aspects.

In the analysis of sleep quality and its interference with work during the pandemic, the questions on this topic were related to the other variables of the questionnaire, and descriptive values were interposed from the cross-tabulations.

The items with the greatest impact on sleep variables were identified through these percentages of the tabulation made, with the analysis eligibility of p-value < 0.005 with a confidence level of 95%. Cronbach's alpha coefficient is an internal consistency measure, which adds a set of items as a group by the average correlation among them. It is considered, therefore, a statistic that measures the reliability of a questionnaire on a numerical scale from zero to one, where 0 would represent no consistency and 1 high reliability (Hair Junior et al., 2003). The reliability study verified the psychometric properties of the King's health questionnaire through the analysis of validity (structural validity and convergent construct) and reliability (internal consistency of the items) of the measurement instrument (Rafael & Silva, 2022). The methodological guidelines were based on the checklist consensus-based standards for selecting the health measurement instruments (Gomes et al., 2021).

Statistical analysis was performed using SPSS 25® software. Responses were first examined for missing values, outliers, and assumptions of linearity, normality, and homoscedasticity. Descriptive statistics were generated to summarize quantitative and categorical variables. Appropriate chi-square, t-tests, and ANOVA were used to establish associations between covariates and the subscale.

3. Results and discussions

3.1. Respondents' profile

The study population comprised 801 individuals who made themselves available to answer the questionnaire and participate in the research. Based on the number of interviews from an infinitive population, the sample size of 801 was estimated with a statistical power test of 0.875 (with a 95% confidence coefficient) in accordance with the Cochran formula. The dataset was processed by SPSS® 23 software. The respondents characterized a response profile through basic questions, such as age, region of residence and work, height, profession area, and work model. Some questions were multiple choice, which allows an N greater than the total number of people in some cases. Regarding age, the profile of the respondents m is mostly in the age group of 18 to 39 years, with 82.49% of the total, as well as more than 90% are in the northeast and southeast regions of Brazil and

height profile corresponds, in meters, from 1.51 meters to 1.90 m (corresponding to 96.38% of the answers). The profile of the area of a regular occupation is diversified, with a high number of respondents in an industrial area, such as chemistry, administration, and engineering.

As for the work model during the pandemic, most people were in the non-face-to-face model, characterized by the home office and workshifting, corresponding to 64.49% of respondents. This gives us a parameter of association with companies' ability to reduce the pandemic's impacts by directing their employees to care for social distancing and avoiding crowds in offices and other workspaces. As for equipment and work tools, more than 80% of the responses showed a remote work profile, with the extensive use of notebooks, heads, and microphones. This equipment provides a tool profile that enables a routine work structure with team meetings and tele-assistance.

Regarding the consumption profile of respondents, there was an increase of 18.01% for fast food orders, compared to a 12.87% increase for healthy food consumption. The questionnaire also showed that 17.73% of respondents had an increase in some addictive substance (alcohol or some psychoactive substance) and 17.32% demonstrated the need for greater coffee consumption against 16.83% of increased water consumption. All the details and information about the demographic data and profile of the studied population are in Table 1.

The productivity analysis during the pandemic was analyzed according to the work model, placing it as the main variable for the response variables and thus understanding the correlations of significance and the results of productive efficiency.

3.2. Preliminary discussion

In analyzing the health problems reported by the respondents, some comparison evaluations were carried out to verify the trend and relationship with the work profile. This profile is divided into 3: face-to-face, home office, and workshiting. Even though the main analysis was based on these profiles, other strong relationships implied significant behavioral and physiological health changes. The highest number of illnesses reported before the pandemic were (n = 1,206): back pain (26%, n = 316), pain in the cervical region (17%, n = 205), pain (16%, n = 192) and tendonitis in the wrist (12%, n = 146 and shoulder (12%, n = 144), based on previous studies (Radulović et al., 2021; MacLean et al., 2022). The effect of pandemic brought illnesses to people who previously had no work-related problems. For this new analysis, there was the same categorized profile of prior illnesses, with incidences of (n = 801): 26% for back pain, 21% for neck pain, 13% for pain, 10% for shoulder tendonitis, and 7% for wrist tendonitis (Gerding et al., 2021; Minoura et al., 2021). For workers, it reflected in psychological illnesses contracted in the same period, with incidences of (n = 801): 50.7% for anxiety attacks, 45.1% for high stress, 44.9% for insomnia, and 43.3% for constant changes of mood. In the list of these psychosocial illnesses and whether there was a search for treatment for them (n = 801), 43.5% reported that they knew their problems, but they did not seek specialized help (n = 366) (Deguchi et al., 2022). The only psychosocial illness relevant to these findings was anxiety crisis, where 13.1% (n= 110) of the people sought specialized help. Regarding the sleep study, there was an incidence of non-regularity and non-continuity of sleep during the pandemic (39.8%, n=801), followed by the incidence of some type of irregularity at sleep time without periodicity (32.7%, n=801) (Bigalke et al., 2020).

3.3. Relations about illnesses

For the profile studied, the research showed significant relationships with some characteristics of respondents' profile and health-related problems (Table 2). There was a strong relationship of the working model with 4 variables: area of work (p=0.000), work equipment used during quarantine (p=0.000), illnesses found during the pandemic (p=0.001), problems reported during the pandemic like sleep, stress, etc. (p =0.010) and future expectations regarding the work performed and the pandemic (p =0.022). There were also relationships with illnesses before the pandemic and those perceived and reported during the pandemic period studied (p=0.000), as well as the sleep profile before and during (p =0.010).

Other significant relationships in the interviewees' profile overlap occupational problems that add to the pandemic. The equipment used in the remote, face-to-face, and mixed work contract, whether donated by the company or purchased by the workers themselves, influences the perception of safety in the workplace (p < 0.0001). In addition to the increased consumption of items considered addictive or harmful to health, such as drugs, sugar, etc. (p = 0.0004). The activity area also influences the appearance of new illnesses (p < 0.0001) and the sleep profile (p = 0.007). The latter has a strong relationship with the appearance of other psychosocial problems (p = 0.000) and the search for professional help for these same problems (p = 0.000), in addition to increasing consumption (p = 0.074).

Table 1. Demographic description, work profile, and consumption of the studied population.

Characteristics	n	%	Characteristics	n	%
Age Group (n=801)			*Height in meters (n=801)*		7
14-15 (apprentice)	3	0.37	1.40 – 1.50	13	1.62
16-17 (internships, fellows, etc.)	4	0.50	1.51 – 1.60	160	19.98
18-29	422	52.68	1.61 – 1.70	308	38.45
30-39	238	29.71	1.71 – 1.80	203	25.34
40-49	87	10.86	1.81 – 1.90	101	12.61
50 or more	44	5.49	1.91 – 2.00	10	1.25
No reply	3	0.37	No reply	6	0.62
Country Region (n=801)			*Working Model (n=842)*		
Northeast	14	1.75	Non-presential	543	64.49
Southeast	587	73.28	Presential	288	34.20
South	16	2.00	Others	11	1.31
Midwest	44	5.49	*Equipment Used at Work (n=1423)*		
North	136	16.98	Fixed Computer	255	17.92
No reply	4	0.50	Laptop/Notebook	432	30.36
General Practice Area (n=850)			Pen, notebook and other writing materials	257	18.06
Food / Restaurants / Diners	27	3.18	Headphones	164	11.52
Industry / Engineering / Chemistry / Administration	229	26.94	Microphone	67	4.71
Teaching and research	122	14.35	Headseat	52	3.65
Health Sector	104	12.24	Landline	45	3.16
Self-employed	63	7.41	Smartphones and Cell Phones	39	2.74
Marketing and Communication	56	6.59	Sound and sound materials	29	2.04
Law / Advocacy	45	5.29	TV and Radio	23	1.62
Banks / Financial	29	3.41	White board	19	1.34
Trade	24	2.82	Overhead projector / Image projector	15	1.05
Tourism / Hospitality	23	2.71	Others	26	1.83
Social media	17	2.00	*Consumption Items during the Pandemic (n=842)*		
Telemarketing / Telephone Service	16	1.88	Fast food	259	18.01
MEI at home	14	1.65	Coffee	249	17.32
Security Sector	13	1.53	Water	242	16.83
Arts / Cultural Artistic Production	12	1.41	Alcohol	208	14.46
Investment / Economy	12	1.41	Healthy food	185	12.87
Public service	12	1.41	Drinks with high sugar content as soft drinks	175	12.17
Others	32	3.76	Psychoactive Substances	47	3.27
			Candy	46	3.20
			Nothing	12	0.83
			Chocolate	9	0.63
			Others	6	0.42

Social distancing was very important in reducing the spread of the pandemic in the world (Namwat et al., 2020) and, especially in the period studied (the initial time of the blockade in several countries), it had a great impact on the reduction of new cases and management of hospital beds (Cirrincione et al., 2020). However, there is an aggravation in other human spectra that must be observed. In the work model during a pandemic-studied period, most were in remote work. The need to adapt remote work at home or in another location that was not conventional in-person, in most cases, enabled the worker to create their work routines, as well as to understand the pace of delivery of their results considering the activities demanded by the companies (Collins, 2005). Many people needed help from the companies to adapt the equipment and infrastructure of the work, either due to the company's restrictions on the worker or imposed on both sides (see Figure 1).

The overall height indicates compliance with the average height of the 5 regions of Brazil (p < 0.0001), consistent with the manufacturing profile of most furniture and electronic equipment in production in Brazil (IIDA, 1990). It does not greatly influence the onset of illnesses and adequate ergonomics for daily work (p = 0.761). However, these choices of equipment and infrastructure studied were made by evaluating the productive capacity of professionals and their physical structure and limitations (Fadel et al., 2020). This lack of ergonomic planning is evidenced in the aby occupational problems, including those that already had the physical infrastructure to enter remote work due to the great demand in the pandemic. All the prevalence and

Table 2. The frequency of patterns of occurrence of physical and psychosocial health effects, a prevalence rate with a 95% confidence interval (CI) and comparisons of trends in work intensity.

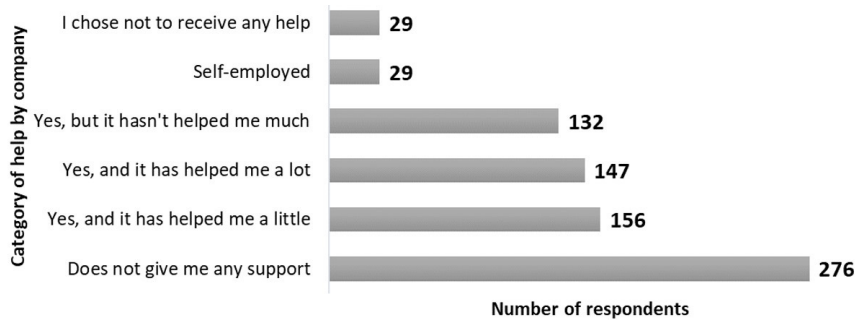| Health effects	n	%	Incidence	Prevalence
Problems related to the extension of the elbow to the wrist/hand, lower back or muscle pain before the pandemic				
Low back pain	316	0.26	-	0.39
Pain in the cervical region	205	0.17	-	0.26
Malgias (muscle pain)	192	0.16	-	0.24
Tendonitis (on the wrist)	146	0.12	-	0.18
Tendonitis (on the shoulder)	144	0.12	-	0.18
Nothing diagnosed yet / I had no problems	55	0.05	-	0.07
DeQuervain's tenosynovitis (pain at the base of the thumb)	41	0.03	-	0.05
Medial epicondylitis (pain in the elbow)	35	0.03	-	0.04
Repetitive strain injury	31	0.03	-	0.04
Tendonitis (in the Elbow)	22	0.02	-	0.03
Knee pain	5	0	-	0.01
Others	16	0.01	-	0.02
Problems related to the extension of the elbow to the wrist/hand, lower back or muscle pain after the pandemic				
Low back pain	207	0.17	0.26	0.653
Pain in the cervical region	168	0.14	0.21	0.466
Malgias (muscle pain)	103	0.09	0.13	0.368
Tendonitis (on the shoulder)	79	0.07	0.1	0.281
I had no problems	72	0.06	0.09	0.27
Tendonitis (on the wrist)	60	0.05	0.07	0.144
DeQuervain's tenosynovitis (pain at the base of the thumb)	34	0.03	0.04	0.094
Medial epicondylitis (pain in the elbow)	27	0.02	0.03	0.077
Repetitive Strain Injury (RSI)	22	0.02	0.03	0.066
Tendonitis (in the Elbow)	17	0.01	0.02	0.049
Others	24	0.02	0.03	0.036
Symptoms and other illnesses during the pandemic				
Anxiety crisis	406	0.232	0.507	-
High stress	361	0.206	0.451	-
Insomnia	360	0.205	0.449	-
Constant mood swings	347	0.198	0.433	-
I didn't develop any kind of problem	158	0.090	0.197	-
Elevated bad mood	113	0.064	0.141	-
Discouragement / Tiredness	3	0.002	0.004	-
Melancholy	3	0.002	0.004	-
Headache	2	0.001	0.002	-
Search for professional help for the detected illnesses				
I had problems but did not seek expert help	366	0.435	-	-
I don't need any expert help	183	0.217	-	-
Anxiety crisis	110	0.131	-	-
High stress	70	0.083	-	-
Constant mood swings	54	0.064	-	-
Insomnia	50	0.059	-	-
Elevated bad mood	7	0.008	-	-
Others	2	0.002	-	-
Regular and continuous behavior of sleep before the pandemic				
Yes	445	0.556	-	0.56
Sometimes	223	0.278	-	0.28
Not	127	0.159	-	0.16
No reply	6	0.007	-	-
Regular and continuous behavior of sleep after the pandemic				
Not	319	0.398	0.398	0.557
Sometimes	262	0.327	0.327	0.286
Yes	216	0.270	0.270	0.825
No reply	4	0.005	-	-

Figure 1. Frequency distribution to help from companies during the pandemic.

incidence shown in the research reinforce the trends of the appearance of illnesses and psychosocial problems relevant to workers' health, configuring occupational problems. Increased consumption, disturbed sleep, irregular sleep, and increased consumption of substances harmful to health demonstrate the care companies must take when categorizing remote work routines.

These same to preserving personal life with social distancing to delay a pandemic caused by a virus with community transmission (Bouziri et al., 2020). New work has entered people's lives and implemented irreversible consequences, as evidenced in diseases and health and psychosocial problems (Nunes, 2005). Generally, with no way out of home and the need for work, you can have new health problems and a definitive and no longer transitory work profile. However, these adjustments must be reviewed by both parties, as the issues for most companies that have entered remote work will no longer return models to traditional face-to-face work (Sant'Anna, 2015). The study of social and ergonomic behavior at home must be carried out to enter in which people accept from the execution of the best work routines. This solution best fits the delivery of results, considering the work or the employee.

3.4. Relations about productivity

Based on these 3 profiles, all respondents were asked about their assessment of productive behavior in their workplace, demands on delivery of results, and perception of their productive efficiency during the pandemic period studied (Table 3). When asked about planning their daily activities, 66.29% (n = 713) of people had some planning, and 88.89% (n = 712) understood that their productivity was affected due to the pandemic. Companies during the pandemic period had a great need to deliver quick results, which led to pressure from them, which led to pressure from their employees, regardless of the work model (Deloitte, 2020).

The respondents were then asked about this pressure, and approximately 65.17% (n = 522) felt some pressure to deliver what companies and organizations needed. The help of companies during this period became something necessary for the good progress of operational results (those who are on the front line), tactical (supervisory and coordination supports,) and strategic (which guide organizations) (Organisation for Economic Cooperation and Development, 2020a).

When asked whether these same companies that remunerate their workers helped with any extra income, extra medical or psychological help, or other help - 54.13% (n = 435) said that there was some kind of help from the companies for this pandemic transition, and 34.46% (n = 276) received a negative from companies in this support. To carry out the activities, with the entire context of preventive methods related to the non-infection of COVID-19 (Organisation for Economic Cooperation and Development, 2021). workers were asked about the work environment in which they perform their work. In terms of quality of work, 40.07% (n = 275) reported that there is some inadequacy in performing their activities according to the quality of the services they provided, and in a broad sense, 82.90% (n = 509) said that the workplace would be suitable for carrying out its functions.

Regarding the suitability of this workplace for preventive and minimizing methods of infections against COVID-19, 44.94% of respondents (n = 230) reported some degree of insecurity. The greatest existing relationship of significance measured by Pearson's coefficient (p) for this insecurity is associated with the face-to-face work model (p < 0.000), and unrelated to the workshiting model (p = 0.969). The greater number of people in the home office was associated with a higher degree of safety against Sars-CoV2 (p < 0.000).

Of the existing relationships with the variable responses regarding the work models (in-person, home office, and workshiting), there are strong relationships with the area of expertise (p < 0.000), with the equipment

Table 3. Profile of perception of productivity and ergonomics at work developed before and during the COVID-19 pandemic.

Characteristics	n	%	Characteristics	n	%
Planning of daily activities (n=801)			*Work environment safety against COVID-19 (n=801)*		
I usually plan	276	22.35	Safe	307	29.96
I always plan	258	34.46	Very safe	240	22.10
Sometimes I plan	179	9.49	Unsafe	177	38.33
I don't plan	76	32.21	Without security	53	6.62
No reply	12	1.50	No reply	24	3.00
Assessment of the degree of difficulty of the work (n=801)			*Help from the institution that pays the worker (n=801)*	n	%
I usually rate	277	22.60	Does not give me any support	276	3.62
I always rate	196	34.58	Yes, and it has helped me a little	156	34.46
Sometimes I evaluate	181	15.23	Yes, and it has helped me a lot	147	3.62
I don't rate	122	24.47	Yes, but it hasn't helped me much	132	18.35
No reply	25	3.12	Self-employed	29	19.48
Workplace in terms of Quality and Convenience (n=801)			I chose not to receive any help	29	16.48
Adequate	406	50.69	No reply	32	4.00
Not adequate	221	12.48	*Workplace adequacy (broad) (n=801)*		
Very suitable	100	6.74	Adequate	422	52.68
Nothing adequate	54	27.59	Not adequate	242	10.86
No reply	20	2.50	Very suitable	87	30.21
Productivity affected by the pandemic (n=801)			Nothing adequate	35	4.37
Affected	269	33.58	No reply	15	1.87
Little affected	231	26.47	*Pressured by Productivity (broad) (n=801)*		
Very affected	212	28.84	Too pressed	277	34.58
No affected	70	8.74	A little pressed	245	30.59
No reply	19	2.37	I don't feel pressured	178	22.22
No reply	16	2.00	No difference from before	85	10.61
Planned Hours (n=801)			*Hourly load performed (n=801)*		
2h	1	0.001	2h	6	0.007
4h	59	0.074	4h	102	0.127
5h	36	0.045	5h	50	0.062
6h	159	0.199	6h	133	0.166
7h	51	0.064	7h	65	0.081
8h	203	0.253	8h	141	0.176
9h	46	0.057	9h	75	0.094
10h or more	84	0.105	10h or more	182	0.227
Don't plan	138	0.172	Variable workload	10	0.012
No reply	24	0.030	No reply	37	0.046
Future Expectation about the pandemic time and your productivity (n=801)					
Expectation as usual, without much change from what it was before	273	0.341			
High expectation of delivering a good result	244	0.305			
Without expectations	120	0.150			
Low expectations because I can't deliver the work the way I want	80	0.100			
Low expectations due to fear of the new coronavirus	77	0.096			
No reply	7	0.009			

available at the workstation (p < 0.000), the security of this job against Sars-CoV2 (p < 0.000), daily planning of activities (p = 0.021), and pressure for productivity to deliver their assignments (p = 0.077).

The area of expertise directly impacts the choice of the work model and activities developed by the organization. Besides, the profile of equipment that should be used to execute the employees' assignments, as most respondent profiles were in a non-presential model (64,49%), there is a greater perception of the security of protection against COVID-19. There were no strong relationships between these work models for questions

about the quality and convenience of the workplace (p = 0.383) and the consequences of the pandemic on the perception of productivity (p = 0.686). This implies that there is not necessarily a loss of quality and productivity regardless of the proposed work model, and the pressure, even if high, would not imply in the chosen remote or in-person model.

Regarding the workload of daily activities before the pandemic, there is a lower significance relationship (p = 0.019) than during the pandemic (p = 0.007). There was a migration of hours worked and an increase in total hours (an increase of 16.93%, with 939 hours more, n = 801) when comparisons were made between before (planned) and during (executed) the pandemic period (Figure 2).

Productivity during the studied period of the pandemic showed a decrease in its qualitative and quantitative aspects in the general world population (Yang et al., 2021). The perception of productive efficiency for the interviewees emphasized the studies on the subject with some relevant findings related to the direct consequences that a pandemic with restrictions and social isolation (Organisation for Economic Cooperation and Development, 2020b) can bring, as well as the economic profile that the country has adopted in the face of the pandemic (International Labour Organization, 2020), which directly reflects on the results of the activities developed by the organizations. The pressure for results found incorporates the scenario of economic uncertainty that the pandemic period brought, allied to the new methodologies and strategies that companies needed to adopt to remedy the gap of low demand for various services and the non-displacement in common and work areas for non-essential activities. The help of these companies was also a factor that directly affected individual productivity, which denotes a concern for companies to stabilize employees in models consistent with strategic realities. And on the other hand, a weakness of other companies that did not have the same perception and were unable to help their employees in some way in this transition in time, especially to the off-site model. One of the constraints of this study was to understand in depth the difficulties that companies had in helping their employees in the transition to the pandemic period. For job security concerning COVID-19, there was a great mobilization by the state government to stabilize the spread of the vírus (Nowakowska, 2021), with limitations in the particularities of the work infrastructure, whether remote, hybrid, or face-to-face. People were not prepared to adapt to the workplace, which is one of the most common concerns for the face-to-face model.

The transfer of hours, according to Figure 1, can predict the other qualitative aspects when individual productivities are analyzed due to the high significance relationships found. People, for working more than planned, and agreeing to their labor agreements, suffer consequences of greater demands for service and, consequently, greater pressure results in a great increase in unemployment (Wang et al., 2020; Yang et al., 2021). The external aspects of work also influenced the negative perception of individual productivity, shown in the hours worked. The particular objective of guarantee their jobs in a period of great uncertainty in the labor market (Thulin et al., 2019). The areas most affected by this accumulation of workload (hours worked more than expected) can be divided on the work model in the pandemic period: (i) health sector in the face-to-face model, teaching, and research in the home office model; and Tourism and hospitality in the workshiting model. The health sector was overloaded to contain the disease's spread to hospitalization cases (Adams & Walls, 2020). The education sector migrated to the non-presential model to meet the demands of teaching and research (Green, 2020). With the fall in tourism, when relevant to the maintenance of jobs, it migrated to the mixed model (Chakraborty & Maity, 2020).
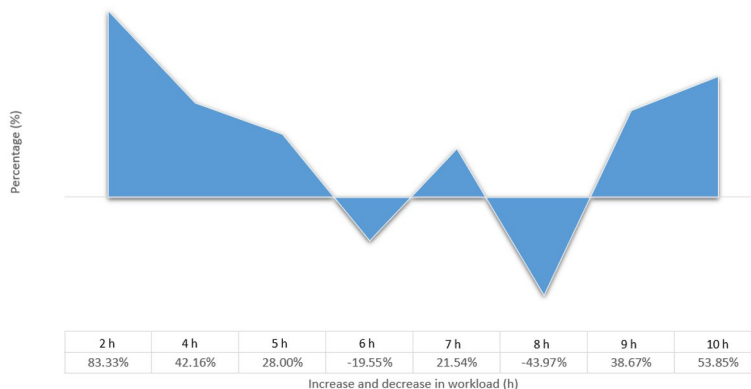

Figure 2. Frequency distribution to migration of residual hours worked and not worked.

4. Conclusions

Work routines have been severely affected by the pandemic, and professionals have suffered from the drastic changes that a pandemic can bring to adapt to the job market. This paper aimed to analyze the productivity and quality of work during the COVID-19 pandemic from five Brazilian regions with three work models: face-to-face, virtual and workshiting.

The results show the importance of the public power to act in the communication and policy of harm reduction in the production chain. The companies that hire and standardize the production models until the rescue of social communication with the representatives of the working classes, seeing their difficulties in balancing the production of goods and services and well-being. There is a need to support the general population with technical and medical support to adapt to social isolation routines and follow hybrid and face-to-face work protocols.

Regarding how it happened, two variables could change the results and consequently change the findings of the relationships: (i) there was a big difference in the amount of variable response in the region. The discovery for each region of Brazil can greatly impact the relationships between other variables; (ii) there was a tendency for variable changes in performance, which can cause strong effects with associated factors of common and new diseases.

In this context, the main contribution of this research is investigating the productivity and quality of work from response measures to deal with the trade-off imposed by the COVID-19 pandemic in three work models. First, actions within the home office activities were important. Still, more was needed to guarantee the quality of work observed by the interviewers, which may have contributed to increasing the employees' level of productivity beyond the work environment. Second, the behavior of workers in the home office in the face of the COVID-19 pandemic is an important work model to be considered in this situation. Third, a face-to-face model conducted under activities that make sense to workers and are rigorously followed can contribute to the impact of the effects of the pandemic on society.

Through estimates and significant relationships inferring responses to decision-making by the public or private power, the need to update the applying authority due to the drastic changes that the pandemic scenario can bring. What was found in the follow-up period during the questionnaire application, there may be a difference in the current scenario, tending to a cross-sectional cohort study, to better follow the evolution of diseases and the worker's perceptive behavior in terms of productivity.

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