

# Predictive variables for feelings of sadness and depression while working remotely in Brazil during the COVID-19 pandemic

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## Abstract.

**BACKGROUND:** Remote work was evidenced in the pandemic and studies in this area increased. Most studies focus on professionals of companies or professors/students in the academic environment. At the same time, non-academic staff, that provide all the support required for the core activities of the institutions (research/teaching/extension activities) have been neglected.

**OBJECTIVE:** This article aims to exploratory analyse which variables (interruptions when working remotely (1), health concerns (2) and fear of contracting coronavirus (3), anxiety and concern about professional career (4), frustration to have cancelled plans and missed opportunities (5) and gender (6)) can impact feelings of sadness and depression experienced by non-academic staff of a university working remotely.

**METHODS:** Using a database on behaviour and feelings of non-academic staff from a Brazilian university working remotely during the COVID-19 pandemic, a binary logistic regression model was structured. In an exploratory manner, six independent variables (presented in the previous item) were analysed in terms of their ability to predict the dependent variable (feelings of sadness and depression).

**RESULTS:** The results presented the prediction power of the independent variables for the dependent variable. The variables regarding concern with their health, increased anxiety and concern about their career presented Odds Ratios of 3.6 (1.4–8.5 – 95% C.I.) and 3.3 (2.2–5.0 – 95% C.I.), respectively, standing out from the other variables.

**CONCLUSIONS:** These results focus on staff at one institution, but they can contribute to better understand feelings and behaviours experienced by professionals working remotely and provide information for debates on the field of COVID-19-related changes of work.

Keywords: Remote work, COVID-19, pandemic, feelings and behaviours

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## 1. Introduction

The first coronavirus SARS-CoV-2 (COVID-19) case was diagnosed in China and quickly spread. The World Health Organization (WHO) is investigating the origin of the outbreak, which might take years to conclude [1]. After a little more than a year from the first diagnosis, more than 116 million cases were confirmed and more than 2.5 million deaths were caused by this new disease worldwide [2].

The need for social distancing to reduce COVID-19 infection rates directly impacted educational institutions [3] and the work environment. Adopting remote work has enabled companies to continue their operations while ensuring worker safety (v3). However, this transition has also generated several challenges for companies and employees [4–6]. Companies needed to ensure data security [4], maintain workers motivation [7], and work productivity [8], and workers faced the challenges of dividing their personal and professional lives [4]. In this sense, Caringal-Go et al. [9] highlighted the role of companies' leaders during this challenging period. For Nagel [10], the pandemic accelerated work transformation, incorporating digital aspects and demanding several major changes of workers at the same time.

Within the literature there are both positive and negative aspects associated with working remotely [11]. Positive aspects can include the flexibility (e.g., time flexibility), reduction of costs [12], and less time spent commuting between home and work [7]. Negative aspects include: the mixing of professional and personal life [7]; the greater possibility of interruptions during professional activities due to some household or family chores [13] (v1); the need for an appropriate place to work at home, previously provided by the company; lack of social contact with co-workers [12]; and psychological isolation [14]. Matli [7], in a study carried out with South Africa professionals, also mentioned the pressure put on people from companies to become more productive while working remotely.

Regardless of the advantages and disadvantages of working remotely, the abrupt changes and uncertainties due to the COVID-19 pandemic caused feelings and behaviours in workers that can lead to more serious mental health problems. Tandon [15] highlights the general increase in risk of mental health disorders due to the COVID-19 pandemic (v2). Conducting activities in a remote work environment within the COVID-19 context has great potential to contribute

to this. Bulińska-Stangrecka and Bagieńska [16] also corroborate this argument, emphasising the impacts of remote work on professionals within Information Technology in Poland. Another Polish study [17], verified the negative impact of remote work on employees mental health. In this sense, as recommended by Birimoglu Okuyan and Begen [18], workers mental health should be addressed during remote work to ensure their well-being, and consider specifically the balance between professional and personal lives.

Among the most affected professionals, nurses are directly affected by emotional stress [19]. The Coren-SP [20] mentions some behaviours arising from remote workers, such as great agitation, discussions, irritability, difficulty concentrating, repetitive and incongruous thoughts, and feelings of sadness, among others. In addition to harming worker health, these feelings affected their daily productivity, and triggered greater emotional instability. Ahmed et al. [21] reported an increase in anxiety and depression indexes due to the COVID-19 pandemic in the sample they studied (1074 Chinese from Hubei province) and Banerjee [22] and Gitahy [23] verified an increase of feelings such as distress, panic attack and unjustified concerns.

Some authors [24–26] also highlight peoples' concerns regarding the economic crisis caused by the pandemic. The pandemic caused unemployment rates to increase and, as a consequence, many people are afraid regarding their professional careers, which has negatively impacted their mental health (v4). Also due to financial concerns, many organisations interrupted projects and investments, which frustrated the personal / professional plans of many workers around the world (v5).

Focusing on the workplace environment, the literature addresses the consequences of having professional and personal activities coexisting in the same place and the need to reconcile this [7, 13]. For example, Feng and Savani [13] mention a greater possibility for interruptions during professional activities when working remotely due to domestic and family chores, such as supporting the learning of school-aged children. Feng and Savani [13] also emphasise the uneven distribution in housework; in general, women need to conciliate more tasks (professionals, familiar and domestics) than men and this reality causes women to be more fatigued, experience stress and even dissatisfaction with the development of professional activities. Mohring et al. [27] corroborates this point of view, mentioning that women working

remotely with children at home during COVID-19 pandemic were less satisfied with their jobs (v6).

In this sense, an important field to be explored is the impact of remote work on employees' mental health, especially when it is considered the increase of mental health problems during the pandemic [15, 21]

Generally, previous studies have focused on professionals of companies or professors/students in the academic environment [28–30]. Within the academic environment, the work of non-academic staff should also be highlighted, as they provide all the support required for the core activities (research, teaching, extension activities) occur. These professionals were directly impacted by the changes caused by the COVID-19 pandemic.

### 1.1. Purpose of this study

To obtain consolidated information and contribute to the expansion of debates on human resources field, this article aims to analyse the predictive power of six variables for the feelings of sadness and depression experienced by non-academic professionals who work in administrative and technical activities (such as information technology, laboratory support, etc.) in a Brazilian university. In this sense, is to generate a first exploratory overview to be used as basis for further studies to focus on the evidenced issues. The variables to be analysed are associated with interruptions when working remotely (v1), health concerns (v2) and fear of contracting coronavirus (v3), anxiety and concern about professional career (v4), frustration to have cancelled plans and missed opportunities (v5) and gender (v6).

This study is exploratory in nature and seeks to understand the influence of these variables on workers feelings. Regarding the sample of this study, non-academic professionals that work at an important university from Latin America participated. The survey considered professionals of different areas (financial sector, secretariat, IT, etc.), with different levels of experience.

## 2. Subjects and methods

This research was conducted through four well-structured stages. A review of some of the relevant literature was conducted to establish the theoretical foundation of the themes remote work and the behaviours and feelings associated with it. Once the theoretical foundation was established, the authors

Table 1  
Variables of Unicamp Observatory database used to structure binary logistic regression model (adapted from Unicamp Observatory)

Variable type	Variable description
Dependent	I felt sadder and depressed
Independent (v1)	I have more interruptions working from home and this affects the progress of my work
Independent (v2)	I became more concerned with my health
Independent (v3)	I became more anxious and worried about my career
Independent (v4)	I am very afraid to contract the coronavirus disease
Independent (v5)	I had many plans cancelled and/or missed important opportunities
Independent (v6)	Gender (declared woman)

became familiar with the Unicamp Observatory database and selected those items most related the propose of this study and that we could related with the literature presented in the introductory section. Specific attention was given to data related to non-teaching staff behaviour during the COVID-19 pandemic, given the lack of information available for this population. To develop the binary logistic model, the variables presented in Table 1 were selected from the database.

Besides the explanations presented about the variables, it is important to do an additional an explanation about the last variable. Variable 6 (gender) had not been initially considered since there are different social possibilities to gender that do not necessarily make it a binary variable. However, as will be explained later, the valid data for the dependent variable and other five independent variables to be consider in binary logistic regression study resulted in cases in which the respondents declared themselves as men or women. Although there were other options available for respondents to choose, no other options were selected. Thus, for the sample analysed, it was plausible to consider the variable gender as binary. In the second analysis, gender was included in the analysis. It should be highlighted that the database used is public, anonymously available on the website of the University<sup>1</sup> (Unicamp Observatory). According to Unicamp Observatory [31], responsible for collecting

<sup>1</sup>More information about these details can be found at [www.cgu.unicamp.br/admin/assets/js/tinyMCE/documents/F1NotaTecnica-Funcionarios.pdf](http://www.cgu.unicamp.br/admin/assets/js/tinyMCE/documents/F1NotaTecnica-Funcionarios.pdf) or in the item "Nota técnica sobre a pesquisa com os funcionários Unicamp" in the link <https://www.observatorio.cgu.unicamp.br/paginas/banco-de-dados>

the data, the questionnaire was sent to the institutional email of the university staff and answers were received from June 25 of 2020 until July 27 of 2020. In the questionnaire, no information that could identify the respondents was asked, enabling anonymous and voluntary participations.

For the dependent variable and independent variables  $v_1$ ,  $v_2$ ,  $v_3$  and  $v_4$ , data from the Unicamp Observatory presented a scale from 1 to 5, in which 1 was totally disagree and 5 was totally agree. In this study, these data were organised in the following manner. Respondents who answered scores 4 and 5 were placed in a category “YES = 1”, referring to a positive response to the statement. Respondents who answered in the original questionnaire scores 1 or 2 were placed in a category “NO = 0” referring to a negative response to the statement. Data from respondents who answered 3 (associated with indifference), who preferred not to answer and respondents that answered “I don’t know” were not included in this study.

Variable  $v_5$  in the original questionnaire, was different than the other variables in that it only contemplated alternatives of agreement (here named as YES = 1), disagreement (here named as NO = 0), “I don’t know” or “I prefer not to answer” (these last two were not considered in our sample). Thus, no adjustments were necessary for this variable.

Considering the details previously mentioned, it was possible to have a sample of 249 cases that responded “YES” and 314 cases for sample “NO” to the dependent variable “I felt sadder and more depressed”. Following the recommendation of Fávero et al. [32], a selection of 249 cases via SPSS software (version 22) was conducted (that is, the selection did not receive any interference from the authors – a random selection) to balance the analysis in the binary logistic regression. Therefore, there was an equal number (249) of “YES” and “NO” cases included in the analysis. With the samples balanced, it was noted that in both samples that all respondents declared themselves as either a men or a women. Thus, the gender option “man” was identified as 0 and gender option “woman” was identified as 1.

The binary logistic regression was then performed. Binary logistic regression is a very useful technique for analysing the influence of independent variables on a binary dependent variable [32, 33]. An important first analysis to be carried out is the identification of outliers that can distort the model. Thus, outliers should be eliminated from the sample, as recommended by Hair et al. [34]. To identify these outliers,

when the Binary logistic regression is first run, the casewise list should be analysed and those cases presenting standardised residual higher than 2 standard deviations should be eliminated. After the elimination, the Binary logistic regression is run again [33]. In addition, it is also necessary to check the multicollinearity of independent variables. According to Field [33], variables can be considered for subsequent analysis in binary logistic regression if the Variance Inflation Factors (VIF) are less than 10 and tolerances are greater than 0.1.

The first model generated in the binary logistic regression was named “Block 0” and did not include any “independent variable”. Subsequently, the independent variables can be inserted under different conceptions, creating blocks, and these blocks are compared to the previous ones in relation to their ability to explain the data pattern [33]. The Omnibus Test allows the performance of the models of these blocks to be compared. In this study, only two blocks were considered: block 0 (without any independent variables) and block 1 (with all the independent variables). In block 1, all the independent variables were inserted in the model at the same time (instead of individually and in steps) because there was no reason to initially justify this decision.

The metrics -2 Log Likelihood, Cox & Snell  $R^2$  and Nagelkerke  $R^2$  are used to evaluate the effect size of the model [33, 34]. For Fávero et al. [32], the Hosmer and Lemeshow test can be understood as a quality assessment of the model proposed and Hair et al. [34] mention that significance values above 5% indicates that the model can be accepted.

Regarding the independent variables allocated in the equation, it is important to highlight that they must have a statistic significance of less than 5% to be considered in the model analysed, according to the recommendations of Hair et al. [34]. Another relevant value resulting from the binary logistic regression analysis is the Odds Ratio for each independent variable. According to Field [33], the Odds Ratio shows the power of independent variables to predict the dependent variable.

In a complementary way and following the recommendations of Fávero et al. [32], the ROC Curve (Receiver Operating Characteristic Curve) was also plotted to verify the discriminating power of the model. The area between the curve and the diagonal is used to measure the quality of the proposed model. According to Fávero et al. [32], the following reference values can be considered: area = 0.5 (there is no discrimination); area between 0.7 and 0.8

(discrimination is acceptable); area above 0.8 (discrimination is excellent).

### 3. Results

The first analysis carried out was the identification of outliers. It was eliminated from the sample those cases that were not representing the population under analysis, as recommended by Hair et al. [34]. Six cases were classified as outliers and they were eliminated from the sample.

Multicollinearity test was also performed to verify if the independent variables were not correlated [34]. As shown in Table 2, the tolerance values are greater than 0.1 and the values of Variance Inflation Factors (VIF) were less than 10 for the independent variables.

With respect to the binary logistic regression analysis specifically, results were initially generated for Block 0 (without any independent variables) and then for Block 1 (with all independent variables). The result of the Omnibus Tests coefficient (that compares

Block 1 and Block 0) showed that the model with all the variables (Block 1) is more appropriate, as presented in Table 3.

Values for  $-2$  Log Likelihood (553.198), Cox & Snell R<sup>2</sup> (0.230) and Nagelkerke R<sup>2</sup> (0.307) were also calculated, and they can be considered adequate for this study.

The Hosmer and Lemeshow test showed a significance greater than 5% (0.359). Considering this result, it is possible to argue that the proposed model has quality as argued by Fávero et al. [32], that is, there is no significant differences between what the model predicts and what is observed. Considering the presented findings, it was possible to obtain a model that classified 71.1% of the cases correctly.

Finally, in Table 4, it is possible to verify the variables that can be considered for analysis (accepted with statistical significance lower than 5%). For the validated variables, the Odds Ratios - “Exp (B)” - shows the impact that the change in each predictor (independent variables) causes in the dependent variable.

As shown in Table 4, the statistical significance for all variables studied is lower than 5%, as well as for the constant. These variables can then be considered predictors of the dependent variable, despite the exploratory character of this study. Besides performing the “Odds Ratio” analysis, ROC Curve was generated. This analysis allows the quality of the model generated to be assessed [32]. Analysing Fig. 1 (that presents an area of 0.775), the content in Table 5 and the information presented in the Methods and Procedures section, especially Fávero et al. [32] guidelines (Hosmer and Lemeshow test with significance values above 5% is acceptable; and ROC curve area between 0.7 and 0.8 means that discrimination is acceptable), it is concluded that the model presents an acceptable discrimination.

Table 6 lists the “Odds Ratios” for each variable in the model. It is presenting the odds ratio for the

Table 2  
Tolerance and Variance Inflation Factor for the variables studied in the model

Var	Tolerance	VIF
v1	0.978	1.023
v2	0.666	1.501
v3	0.884	1.131
v4	0.682	1.467
v5	0.936	1.068
v6	0.988	1.013

Table 3  
Results for the coefficient of the Omnibus Tests between Block 1 and Block 0

		Chi-square	df	Sig.
Step 1	Step	128.827	6	0.000
	Block	128.827	6	0.000
	Model	128.827	6	0.000

Table 4  
Information for the analysed variables

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1	v1	1.070	0.285	14.076	1	0.000	2.9	1.7	5.4
	v2	1.270	0.447	8.066	1	0.005	3.6	1.5	8.5
	v3	1.208	0.211	32.689	1	0.000	3.3	2.2	5.1
	v4	0.659	0.313	4.422	1	0.035	1.9	1.0	3.6
	v5	0.940	0.211	19.848	1	0.000	2.6	1.7	3.9
	v6	0.575	0.215	7.150	1	0.007	1.8	1.1	2.7
	Constant	-3.336	0.463	51.870	1	0.000	0.0		

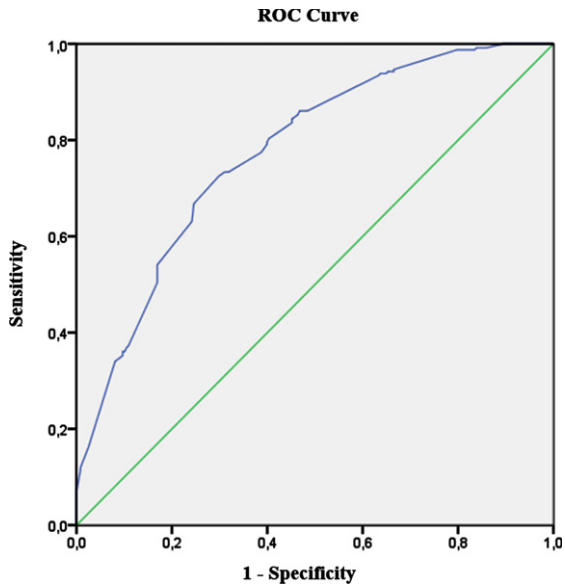


Fig. 1. Receiver Operating Characteristic Curve for the generated binary logistic regression model.

Table 5  
Information associated to the ROC Curve

Area	Standard error	asymptotic sig.	Confidence interval 95% asymptotic	
			Inferior limit	Upper limit
0.775	0.021	0.000	0.735	0.816

dependent variable when the value of the independent variable is changed to 1.

#### 4. Discussion

Regarding variables v2 and v4, associated with “health aspects”, they can be understood as strong

predictors of feelings of sadness and depression in the sample respondents, since their values are 3.6 (95% C.I.) and 1.9 (95% C.I.), respectively. The presented findings are partially in line with the study of Salari et al. [35], in which the authors concluded that concerns arising from the COVID-19 pandemic increase the chances of stress, depression and anxiety in some people. In our research, sadness and depression were considered.

Focusing on aspects of job and professional career, variables v1, v3 and v5 are they are better predictors than V2 for the dependent variable. People who manifest many interruptions in their jobs routines when working at home (v1) often become dissatisfied with the progress they are making in their professional activities, increasing the chances of feelings of sadness and depression (Odds Ratio of 2.9). Mohring et al. [27] analysed the satisfaction of collaborators acting in remote work throughout the COVID-19 pandemic and highlighted a pronounced decline in satisfaction in some groups, including women professionals with children (as it is known, they have many interruptions from their children during the workday in general).

It is known that the COVID-19 pandemic caused a serious world economic recession and, as a consequence, many companies experienced financial problems, causing layoffs and compromising investment plans of companies. Many people had plans cancelled and they become anxious and worried about their careers and financial security. These themes were addressed in our study in variables v5 and v3, respectively and results confirmed that they are strong predictors for feelings of sadness and depression. For variable v5, the odds ratio was 2.6 and for variable v3 it was 3.3. Once again, these results can be associated with the study of Salari et al. [35], who mentions that concerns arising from the COVID-19 pandemic

Table 6  
“Odds ratio” for validated variables

If the respondent agrees that:	Consequently, he/she presents
He/she has more interruptions when working from home and that this affects the progress of his/her work (v1)	2.9 times more likely to report feeling sadder and depressed.
He/she became more concerned with his/her health (v2)	3.6 times more likely to report feeling sadder and depressed.
He/she became more anxious and worried about his/her career (v3)	3.3 times more likely to report feeling sadder and depressed.
He/she is very afraid of getting the new coronavirus (v4)	1.9 times more likely to report feeling sadder and depressed.
He/she had many plans cancelled and/or missed important opportunities (v5)	2.6 times more likely to report feeling sadder and depressed.
She is a woman (v6)	1.8 times more likely to report feeling sadder and depressed.

increase the chances of stress, depression, and anxiety in people.

Finally, an important finding of this study which is consistent with others' research refers to the prevalence of women as those most affected by the pandemic. The results showed that women were 1.8 times more likely to feel sad and depressed compared to men. Recent studies show that the prevalence of depression, stress and anxiety during the pandemic of COVID-19 affect more women than men [13, 27, 36].

Before presenting the conclusions, it should be highlighted the limitations of this research. Limitations are always present in any scientific research and it is no different in this study. We mention the possible influence of specific characteristics of Brazilian reality (such as the economic and politic instabilities). Another limitation to be mentioned is the fact that we follow the guidelines of Fávero et al. [32], in which the dependent variable should be the factor used for sample balancing. We understand that this is a limitation of the research, since other variables could be used for sample balancing, but we highlight that, although it is a limitation, this procedure is directly related to the research goal. The lack of literature about the issues addressed did not enable us to order the independent variable insertion into the regression; thus, they were all inserted at the same time, which is justified considering the exploratory character of the research. The variables (dependent and independents) selected to investigate in this research can also be characterised as a limitation, but they delimited the scope of this study. In addition, it should be mentioned that in this research, our goal was to generate a first exploratory overview to be used as basis for further studies to focus on the evidenced issues. The findings are linked with the moment of the pandemic in which data was collected. Although the research may be replicated in other periods, this first overview is essential for researchers in Brazil and in other countries to base their further analysis.

## 5. Conclusion

The COVID-19 pandemic has brought significant changes to people's personal and professional lives. Regarding professional environments, there was an increase of the remote work and with it, studies about mental health problems presented by professionals acting far from companies also have increased.

This study assessed the capacity of six variables to predict the feelings of sadness and depression, using binary logistic regression model and responses of non-teaching staff from a Brazilian university. It is concluded that the six variables studied have predictive capacity for the feelings mentioned. Comparatively, health and career concerns have the highest odds ratios.

The main contribution of this study is to present initial information to guide researchers in further studies on "remote work" or to be used as a basis for debates in private and public institutions. As a theoretical contribution, this study reinforced the arguments presented by other authors. The robustness mentioned can be checked by the indexes of the logistic regression model generated. It is worth remembering that the participants, despite working in a Brazilian university, are non-teaching staff and carry out activities of different types, as occurs in any business organisation. Although the findings are focused on the sample analysed, the results of our research provide evidence of the prediction power between the six independent variables analysed and feelings of sadness and depression.

As a future study, we suggest that the same analysis be conducted in other countries with subsequent comparison of results. It is important to develop post-COVID-19 plans that contemplate the increase of discontent and mental illness in the workplace. In addition, comparisons of the pandemic impacts between professionals working in academic institutions and people with different lifestyles would also contribute positively to the literature in this area. A third research opportunity is the comparison of the impacts analysed in this study considering respondents ages to identify possible age ranges in which the impact caused are greater.

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## Conflict of interest

None to report.

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