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THE COVID-19 PANDEMIC AND PERSONAL SPENDING ON PROTECTION IN BRAZIL

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ABSTRACT

The two main questions addressed in this study are: What are the key drivers to spending on personal protective equipment (PPE) attributable to SARS-COV-2 risks? What are the welfare consequences of SARS-COV-2-induced changes in expenditures of personal individuals? We carried out an online survey conducted on internet and social media networks. We observed that the respondents most likely to spend a higher fraction of income on PPE expenditures are the ones who know someone who died from SARS-COV-2 and the ones who are married. Male respondents are less likely to purchase PPE. Individuals who can afford private health insurance are more likely to spend a higher proportion of income on PPE expenditures than others. Therefore, the higher the income and the number of deaths by SARS-COV-2 locally, the greater the amount spent with such purchases. The presence of children or other persons who need care in the respondent's household affects positively as well.
Keywords: SARS-CoV, protection behaviour, health care expenditures.
JEL Classification: C83, D10, I12.

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LA PANDEMIA DEL COVID-19 Y LOS GASTOS PERSONALES EN PROTECCIÓN EN BRASIL

RESUMEN

Las dos preguntas principales que se abordan en este estudio son: ¿cuáles son los factores clave para el gasto en equipo de protección personal (EPP) atribuibles a los riesgos del SARS-COV-2?, ¿cuáles son las consecuencias para el bienestar de los cambios inducidos por el SARS-COV-2 en los gastos de los individuos? Realizamos una encuesta en internet y redes sociales. Observamos que los encuestados con mayor probabilidad de gastar una fracción más alta de ingresos en EPP son los que conocen a alguien que murió de SARS-COV-2 y los que están casados. Es menos probable que los encuestados varones compren EPP. Las personas que pueden pagar un seguro médico privado tienen más probabilidades de gastar una mayor proporción en EPP que otros. Por lo tanto, cuanto mayor sea el ingreso y el número de muertes por SARS-COV-2 a nivel local, mayor será la cantidad gastada con dichos productos. La presencia de niños u otras personas que necesitan cuidados en el hogar del encuestado también afecta positivamente.

Palabras clave: SARS-CoV, comportamiento de protección, gastos en atención médica.

Clasificación JEL : C83, D10, I12.

1. INTRODUCTION

The SARS-CoV-2 pandemic has permanently impacted billions of people around the world. The novel RNA coronavirus has spread across 222 countries, with nearly 4.27 million people succumbing to the pandemic by August 2021. The World Health Organization (WHO) declared it a pandemic due to the widespread infectivity and high contagion rate (Almaghaslah *et al.*, 2020). Humanity is facing a real disaster with global implications.

Brazil has become the epicenter of the epidemic on the continent. As of February 3th, 2021, it has totaled 226k deaths and almost 10 million confirmed cases. Social distancing became the primary tool available to mitigate the epidemic (National Academies of Sciences, Engineering,

and Medicine, 2020). However, this fact does not seem alarming for most Brazilians —56% do not consider social isolation as an effective measure to prevent the spread of COVID-19 (Ipsos, 2020). The number of Brazilians who declare not being afraid of COVID-19 has fallen from 26% on March 3rd to 18% on August 18th (DATAFOLHA, 2020).

The Centers for Disease Control and Prevention (CDC) released recommendations regarding the use of cloth face coverings (CDC COVID-19 Response Team, 2020) after evidence that airborne transmission by asymptomatic individuals might be a key factor in the global spread of SARS-COV-2. Masks can provide a critical barrier, reducing the number of infectious viruses in exhaled breath, mostly by asymptomatic people, and by people with mild symptoms (Leung *et al.*, 2020). WHO released a document that includes a section on recommendations to decision-makers on masks for healthy people in community settings (WHO, 2020).

The mandatory Universal masking was the main reason some places have been most effective in reducing the spread of SARS-COV-2, for instance, in Taiwan, Japan, Hong Kong, Singapore, and South Korea (Prather, Wang, and Schooley, 2020). Zhang *et al.*, (2020) defend that wearing face masks in public corresponds to the most effective means to prevent interhuman transmission. This practice should be in conjunction with simultaneous social distancing, quarantine, and contact tracing, represents the most possible fighting opportunity to stop the SARS-COV-2 pandemic before developing a vaccine.

Since the outbreak of this pandemic, Brazilian families have changed their daily routines, started working and learning from home, and have adopted other defensive behaviours to protect their members from getting infected by SARS-COV-2 (Bezerra *et al.*, 2020). Some families have become more precautionary about protocols and updated procedures, all subject to constant amendments. The number of Brazilian citizens wearing masks raised — 92% declared to wear a mask always when they are not at home (DATAFOLHA, 2020). Individuals adopt behavioral choices in response to risk (Geoffard and Philipson, 1996; Reluga, 2010).

Considering that the expected utility associated with such decisions may include the possibility of future infection when choosing between behaviors such as vaccination choices or different levels of interpersonal contact (Galvani *et al.*, 2007). Assumed the people commonly respond to disease risks by limiting contacts, but the private incentives could be

insufficient to change their behaviors in order to support broader public health goals (Ginsberg *et al.*, 2009).

This answer also seems to respond to socioeconomic vectors. The global estimate showed a drop of between 26-74% in informal workers' earnings among poor and middle-income countries due to the Pandemic (ILO, 2020). In impoverished populations, the potential monetary cost could reach US$73 to US$345 million per day (Sumner, Ortiz-Juarez, and Hoy, 2020).

In Brazil, there was a loss of income during the Pandemic (Bezerra *et al.*, 2020; Duque, 2020). Poor socioeconomic conditions can represent a 50% increase in the risk of dying (Bermudi *et al.*, 2020). For people of low socioeconomic status, several factors increase their exposure to COVID-19 (Patel *et al.*, 2020). What demonstrates that the COVID-19 Pandemic has its impact aggravated by economic, gender, and racial inequality (Martins-Filho *et al.*, 2020; George and Ortiz-Juarez, 2020). The literature has demonstrated the unequal impact of the Pandemic in Brazil is related to housing conditions, where the indicators of housing conditions are far from ideal for a large part of the population (IBGE, 2020).

Although ongoing research is assessing the economic ramifications of SARS-COV-2, most of these studies are focused on the macroeconomic and financial impact of the pandemics. Little has been written at the microeconomic level, for example, regarding changes in consumption patterns, especially the consumption of products and services related to protection against the SARS-COV-2 pandemic. Trying to fill some gaps about the current pandemic, we intended to respond to the following question: What are the drivers to spending on personal protective equipment (masks, alcohol gel, and other protection) attributable to SARS-COV-2 risks? What are the welfare consequences of SARS-COV-2-induced changes in expenditures of personal individuals?

We conducted an online survey carried out on the internet and social media networks and executed Heckman's methods (1974, 1979). Our main findings point out that male respondents are less likely to devote a higher fraction of income on personal protective equipment (PPE) expenditures than women. The result indicates risk-averse behavior for women, possibly due to limitations on their budget. Individuals who have private health insurance are more likely to spend on protective measures against SARS-COV-2 than those who do not.

PPE expenses are positively affected by income. We try to analyze the impacts of these variables as a proportion of income. Finally, the relative impact of PPE on income is more prevalent in the most vulnerable groups, such as women, older people, those who do not have health insurance, and those who live in regions with the most deaths caused by COVID-19.

2. METHODOLOGY AND MODELLING

2.1. Empirical strategy

Our expenditure estimates are based on a censored sample, subject to a selectivity bias. That motivated us to adopt the two-stage procedure proposed by Heckman (1974, 1979). In the first stage, the proposed version comprises decision modelling, from which the inverse Mills ratio can be obtained for each point in the sample.

The adjustment model aims to minimize the influence of those who did not have expenses in the sample to correct the primary model. Thus, the Sample Selection Model developed by Heckman (1979) is considered the most adequate to estimate equations of this type, since it corrects the problem of sample selection bias that the Ordinary Least Squares (OLS) estimation usually presents.

The Heckman model allows the correction of the bias originated by the issue of the expenditure of individuals in defensive spending. Firstly, a participation equation is estimated which includes only individuals who have attributes that make up the sample, the so-called selection equation. Next, we explain the proportion of defensive equipment expenditures earned by individuals according to the selection made in the first estimation. The probability of the individual having expenditures with defensive equipment is estimated with the following selection equation:

$$Y_{1i} = Y_{1i}^{*} = W_{1i}'\beta_1 + \varepsilon_{1i} \qquad [1]$$

where Y_{1i}^{*} is an unobservable random variable that represents the impact of individuals who did not have expenses, but who could have had them. Thus, we can define a discrete random variable Y_{1i}^{*} that reflects the choice: 0 if the individual had no expense, and 1 if the individual had an expense.

W_{1i} is the vector of individual characteristics, β_1 is the vector of coefficients associated with the model and ε_{1i} is the error term that is distributed according to a normal $\left[0, \sigma_1^2\right]$. Thus, the adjustment model to be estimated is given by the equation:

$$P\left(pp.equip = 1\right) = f\left(gender, married, d.contact\right) \quad [2]$$

where *gender*: Binary for gender differentiation between male (1) and female (0); *married*: Dummy that captures the effect of being married (1) and other classifications (0); *d.contact*: Binary that captures the effect of the person knowing someone infected by SARS-CoV-2 (1) or otherwise (0).

In this first stage the likelihood of spending or not, is estimated by regressing a Probit model whose dependent binary variable is 1 if the respondent has spent on defensive equipment and 0 otherwise. The second stage comprises the estimation of a function for fraction of PPE expenditures on income (*ppe_income*), as a dependent variable.

The regressions corresponding to the second stage are estimated using only observations corresponding to the respective positive expenditure. Estimates of expenditure equations with defensive equipment for SARS-COV-2 using the Ordinary Least Squares (OLS) model. For more details on Heckman's procedure, see Hoffmann and Kassouf (2005); Greene (2003) or Heckman (1979).

In the second stage, we estimate the following equation:

$$LN\ln\left(ppe\_income\right) = \beta_0 + \beta_1 gender + \beta_2 age + \beta_3 race + \beta_4 \ln deaths + \beta_5 care + \beta_6 \ln income + \beta_7 h.insurance + \alpha\lambda + \varepsilon \quad [3]$$

where *age*: Variable measured in years and used as an experienced proxy; *race*: Dummy assumes value equal to 1 if the person is white and zero for otherwise; *ln.deaths*: The logarithmic variable that measures deaths by COVID-19 by Brazilian municipality at the time of data collection; *care*: Binary variable that captures the presence of dependent children in the family unit; *ln.income*: The logarithmic variable that measures the individual's income; *h.insurance*: Binary variable that captures the effect of the person having health insurance; λ represents the inverse of the Mills ratio; ε is a random error.

2.2. Explanation chosen variables

There are some considerations about the variables used in this analysis. Most of the evidence on risk perception has come from studies during previous pandemics. For this reason, not all variables in our model come from previous studies that analysed risk perception at the individual level. In general, recent models of risk perception and decision making highlight the division between 1) deliberative and 2) affective or experiential components (Ferrer and Klein, 2015).

One of the main challenges of this step was to choose the appropriate variables to provide the best estimates of risk related to the adoption of protective behaviours considering deliberative and affective components. To choose the measurement variables we rely on the work of Dalecká *et al.* (2021), Schneider *et al.* (2021), Dryhurst *et al.* (2020), and Sobkow *et al.* (2020). To the variables related to the personal characteristics of individuals, we added variables such as gender, race, and marital status, as in other studies (Dalecká *et al.*, 2021; Schneider *et al.*, 2021; Dryhurst *et al.*, 2020; Sobkow *et al.*, 2020).

The *gender* variable serves to capture whether spending on defensive equipment occurs in different proportions for both male and female. The *race* variable represents a binary disaggregated into two groups (white and non-white), whose objective is to verify a possible distinction in the propensity to spend on defensive equipment. The *married* variable aims to measure marital status's effect on the probability of spending on equipment.

To capture the effect of human capital characteristics, the variable *age*, measured in years and used as a proxy of experience, and the variable *income* (Dalecká *et al.*, 2021; Schneider *et al.*, 2021; Dryhurst *et al.*, 2020). Concerning income, we expect that individuals with the highest income will have the highest expenditure (in absolute terms) on defensive equipment, but not in relative terms (fraction of income).

We introduce some variables seeking potential effects on respondents' protective actions. For example, the variable *deaths* captures the effect of the number of deaths in the individual's municipality on spending on defensive equipment. We hypothesize that a more significant number of dead people can increase the respondent's notion of risk, making them want more protection for themselves and their families. We also sought

to analyse whether the presence of private health coverage (*h.insurance*) has significant effects on respondent behaviour in the face of the COVID Pandemic.

2.3. Data and sources

This dataset aggregates data from three primary sources:

- Ministério da Saúde <https://covid.saude.gov.br/>: Official page of the Brazilian Ministry of Health who has provided the number of cases per municipality.
- Brasil.IO <https://brasil.io/dataset/covid19/caso/>: Data compiled daily from the official epidemiological reports of each federative unit.
- Primary data collected from an online survey developed by authors.

This cross-sectional study used a form prepared on Google® Forms and disseminated via internet and social media networks between June 4th and 9th, 2020. According to the rules of resolution 510/1617 (Ministério da Saúde/Conselho Nacional de Saúde, 2016), the opinion survey format was prepared and did not request any identification. The research gathered data among the Brazilian population's universe, configuring a non-probabilistic sample with a convenience bias. We use R Studio 3.6 to perform all the analyses and estimates in this paper. The dataset is available in CSV format at a GitHub repository (https://github.com/cccneto/covid).

3. RESULTS

There were 1,193 responses obtained from 24 Brazilian states, with different proportions in the number of respondents. After cleaning the data, removing the observations from respondents under 18 years, and with inadequate filling, the sample reduced to 1,151 observations. Of the responses, 447 were complete observations (respondents answered all questions), and 704 observations had at least one missing value. Due to number of missing values, we decided to run a Multivariate Imputation via Chained Equations by MICE package of R Programming following Buuren and Groothuis-Oudshoorn (2011) instructions. We

chose to create only 5 (m = 5) imputed datasets, yielding six datasets overall. After running the MICE package, we achieved 6,907 observations. After inserting the following conditions (Age > 16, income > 0 and income > PPE spends) we obtained 6,595 observations. The Table 1 reports summary statistics on the data employed in econometric model presented in section 2.

The results for the best model specification as Heckman selection models are presented in Table 2. All predictor variables are statistically independent without collinearity.

The error term for ρ (rho) is –1.781, meaning that the unobserved factors that motivate purchases are negatively correlated with one another. For the second stage, the goodness-of-fit statistic —R^2— is 0.275. The parameter estimates and the associated p-values are exhibited in Table 1. The variable *Invmills* (Inverse Mills Ratio) is statistically significant at the 0.01 level (–0.1521), indicating evidence of sample selection bias. In other words, whether or not spending on protection is not random. About the average spending on PPE was $ 31.4[1], while the average income was $1,052. Overall, respondents spent approximately 3% of their monthly income on protective equipment against SARS-COV-2.

Respondents who know someone who died from COVID-19 (0.406, p-value < 0.01) and are married (0.268, p-value < 0.01) are more likely to purchase personal protective equipment. Male respondents (–0.428, p-value < 0.01) are less likely to purchase personal protective equipment.

Recall that *h.insurance* is a dummy variable which equals 1 when the respondent is covered by private health insurance. Having private health insurance is a significant indicator of protective behaviour as could be observed in the study. Individuals who have private health insurance coverage are more likely to spend a higher fraction of income in PPE expenditures than others (0.001, p-value < 0.01). As expected, the higher the respondents' income, the smaller the fraction of PPE expenditures (–0.004, p-value < 0.01).

Furthermore, regarding age and gender, it was noticed that male and older respondents are more likely to spend a higher fraction of income in PPE expenditures than otherwise, respectively (0.000, p-value < 0.01)

[1] U$ 1 = RS$ 5,409, the exchange rate between Real and Dollar on August 28, 2020.

Table 1. Summary descriptive table by groups of *gender*

	Female N = 4,027	Male N = 2,568	Overall N = 6,595
pp.equip			
Mean (SD)	0.064 (0.17)	0.971 (0.16)	0.982 (0.13)
Median [Min, Max]	1.0 [0, 1.0]	1.0 [0, 1.0]	[0, 1.0]
ppe_income			
Mean (SD)	0.059 (0.08)	0.059 (0.08)	0.055 (0.08)
Median [Min, Max]	1.0 [0, 1.0]	1.0 [0, 1.0]	[0, 1.0]
d.contact			
Mean (SD)	0.24 (0.43)	0.249 (0.43)	0.241 (0.42)
Median [Min, Max]	0 [0, 1.0]	0 [0, 1.0]	0 [0, 1.0]
Married			
Mean (SD)	0.42 (0.49)	0.49 (0.50)	0.461 (0.499)
Median [Min, Max]	0 [0, 1.0]	0 [0, 1.0]	0 [0, 1.0]
Age			
Mean (SD)	37.3 (12.0)	38.5 (12.9)	38.2 (12.3)
Median [Min, Max]	35.0 [16.0, 79.0]	36.0 [16.0, 76.0]	35.0 [16.0, 79.0]
Race			
Mean (SD)	0.53 (0.50)	0.47 (0.50)	0.510 (0.500)
Median [Min, Max]	1 [0, 1.0]	0 [0, 1.0]	1 [0, 1.0]
ln.deaths			
Mean (SD)	3.85 (2.67)	3.96 (2.55)	3.90 (2.62
Median [Min, Max]	4.34 [0, 8.53]	4.43 [0, 8.53]	4.36 [0, 8.53]
Care			
Mean (SD)	0.39 (0.49)	0.38 (0.49)	0.395 (0.487)
Median [Min, Max]	0 [0, 1.0]	0 [0, 1.0]	0 [0, 1.0]
ln.income			
Mean (SD)	7.75 (1.93)	8.45 (1.04)	8.24 (1.03)
Median [Min, Max]	8.10 [0, 10.4]	8.52 [0, 10.6]	8.29 [0, 10.6]
h.insurance			
Mean (SD)	0.72 (0.45)	0.71 (0.45)	0.728 (0.445
Median [Min, Max]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]

Table 2. Estimated results of the Heckman procedure

	Coefficient	Standard error
First Stage (Probit Selection - Equation [1])		
Gender	–0.4285***	0.0842
d.contact	0.4064***	0.1247
Married	0.2680***	0.0869
(Intercept)	2.1625***	0.0702
Second Stage (OLS Outcome - Equation [2])		
Gender	0.0013***	0.0003
Age	0.0000***	0.0000
Race	0.0001	0.0000
ln.deaths	0.0003***	0.0000
Care	0.0005**	0.0003
ln.income	–0.0049***	0.0001
h.insurance	0.0014***	0.0002
Invmilss	–0.1521**	0.0645
(Intercept)	1.048***	0.0008
Observations	5,892	
R2	0.275	
Adjusted R2	0.274	
Rho	–1.781	

Note: Significance is indicated as follows: ***, ** and * for 1%, 5% and 10%, respectively.

and (0.001, p-value < 0.01). We monitored the official number of deaths by COVID-19 and the results were statistically significant (0.0003, p-value < 0.01) and suggest that this variable positively affects the fraction of PPE expenditures in income. Also, we observed that the presence of children or other persons who need care in the respondent's household is a statistically significant factor affecting the fraction of income spent on PPE expenditures (0.0005, p-value < 0.05).

4. DISCUSSION

According to the according to the Brazilian Institute of Geography and Statistics (IBGE), the expenditure equivalent to 3% of the monthly income directed to protection for SARS-COV-2 seems to corroborate Brazilians' average monthly expenditure on hygiene and personal care, and accounts for 3.6% of their income (IBGE, 2019). It does not seem to represent an actual weight in income since the main actions to prevent contagion are related to better hands hygiene and the use of masks that, in general, can be made by using simple materials.

Considering that 30.1% of employed people in Brazil have experienced a reduction in their income (IBGE, 2020), even though referring to simple care, this expense to avoid SARS-COV-2 has become another burden and exposure factor, especially concerning poorest groups. The pandemic's impact on Brazilians' consumption has already been observed, with changes in habits and about 26% of the population's inability to pay all debts (Opinion BOX, 2020).

The results suggest that the higher the income, the smaller the respondents' propensity to spend. These findings suggest a negative correlation between income and the fraction of income expended in PPE, as expected. In our sample, we could find that people with lower income have expended a higher fraction of income in PPE. In developing countries, generally, around 70% of workers are in informal employment (ILO, 2018). In Brazil, 3.2 million employed people were fired because of the pandemic and no longer received remuneration (IBGE, 2020). The situation impacts the inequality of exposure to the virus, the prevalence of antibodies against SARS-COV-2 in people living in the poorest districts is 2.5 times higher than in the wealthiest districts (Tess *et al.*, 2020).

The pandemic has worsened the social situation around the world, pushing people into extreme poverty (Mahler *et al.*, 2020; Sumner, Ortiz-Juarez, and Hoy, 2020), increasing inequality, also escalating and, consequently, strengthening the discussion about the need of a universal basic income (George and Ortiz-Juarez, 2020).

The Brazilian government has approved a temporary emergency aid for the affected low-income people. The average real household income per capita received in July is US$ 239, 2.9% above the value received in June / 2020. Regions such as Northeast and North had the lowest values,

US$ 169 and US$ 170, respectively. The proportion of households that received some assistance related to the pandemic in Brazil went from 43.0% to 44.1% in July, with an average benefit amount of US$ 168 per household (IBGE, 2020).

The PNAD-COVID-19 by Duque (2020) reveals the loss of household income per capita during the pandemic. With the replacement coming from the emergency aid, there was a contribution to reducing the loss of wages in August 2020. As a consequence, there was a reduction in poverty and extreme poverty thanks to government assistance. However, with the decrease of emergency aid, the average income was pulled down again, especially for the poor people from the north and northeast regions. This movement caused an increase in the percentage of people living on the poverty and extreme poverty lines. This also caused inequality levels to change, the Gini Index went from 0.474 (September 2020) to 0.494 (November 2020), with an upward bias for the coming months.

Unfortunately, in this paper we do not include any information about housing conditions in the model. Several studies have demonstrated the unequal impact of the Pandemic in Brazil is related to housing conditions, where the indicators of housing conditions are far from ideal for a large part of the population (IBGE, 2020). Moreover, this precariousness of Brazil's housing situation seems to be a limitation to fighting the pandemic (Pires, 2020). In a recent survey (Bezerra *et al.*, 2020), it was observed that the average number of people per household during social isolation in the interviewed group was 3.2 people and that the highest percentage of respondents are experiencing isolation in homes with 2 to 4 people. Other data demonstrated that elements related to the quality of homes, such as green and open areas, space for sports practice, among others, influence the probability of adopting social isolation (Silva *et al.*, 2020).

A larger number of people per dwelling and the lack of adequate housing conditions favour the intense circulation of respiratory pathogens (Ribeiro, Lima, and Waldman, 2020). The vulnerable populations are impacted by SARS-COV-2 disproportionately (Martins-Filho *et al.*, 2020). Preliminary data show that the risk of death from COVID-19 is 50% higher (Bermudi *et al.*, 2020).

The progression of the pandemic has exacerbated other inequalities, such as the ones related to gender and ethnic groups (George and Ortiz-Juarez, 2020). In our sample, we could not state a statistical difference

between white and non-white individuals. However, the spread of SARS-COV-2 is greater among self-declared black residents than among whites (Baqui *et al.*, 2020). We could not confirm the hypothesis that the non-white population has an unfavourable economic profile.

In our survey, we observed that 34.7% of blacks do not have private health insurance coverage. When comparing these results with results from the Ministry of Health, which show something around 78%, it seems underestimated. There are 47 million beneficiaries in Brazil, 53.3% women, and 46.7% men (Ministério da Saúde/Agência Nacional de Saúde Suplementar, 2019). The coverage rate of private insurance health plans by states varies between 10.6% and 35.1%, with a national average of 24.2%. Mostly non-white individuals are the ones who need to resort to the public health system, which has struggled to cope with the rapid increase in the number of coronavirus cases.

Differences in the commitment to spend a fraction of income to avoid the contagion with SARS-COV-2 related to income and racial issues highlight the pandemic inequality and demonstrate the impact of information on how people react against the COVID-19 pandemic. The age variable is a predictive factor in respondents' defensive behaviour. There is a positive correlation with the fraction of income dedicated to defensive spending. The older respondents tend to spend a higher fraction of their income on defensive equipment.

The severe forms of SARS-COV-2 are more likely to develop in older people and those with underlying medical conditions (Banerjee *et al.*, 2020), and have a higher chance of lethality (CFR) [Tess *et al.*, 2020; Banerjee *et al.*, 2020; Shahid *et al.*, 2020]. American CDC data indicate 4,226 deaths in the USA, resulting in a CFR of less than 1% in patients under 54 years of age. The number rises to 11% in patients aged 65 to 84 and 10%-27% in patients older than 85 years (CDC, 2020). Elderly patients are disproportionately affected by the SARS-COV-2 pandemic (Richardson *et al.*, 2020).

The numbers may reach even worse rates because during contamination by SARS-COV-2 at least 19 million adults had multimorbidity, which is the presence of at least two comorbidities, and it increases the risk of death (Nunes *et al.*, 2017). In Brazil, 46% of the elderly respondents in Brazil indicate that they are terrified of being infected (DATAFOLHA, 2020), and this is reinforced by the high probability of them being in

isolation (Silva *et al.*, 2020). It is also why the group of people aged 60 or over was substantially withdrawn from work due to pandemics. In June, 23.0% of people aged 60 or over were on leave, but this percentage dropped to 15.4% in July (IBGE, 2020).

Those who knew someone who died victim of COVID-19 are more likely to be aware of the risk and this explains why they spend a higher portion of income on PPE. Most people (92%) say they always wear a mask when they leave home, though they believe that only half (52%) of the residents of their cities do the same (DATAFOLHA, 2020). The greater propensity to spend on protection, therefore, seems to be a natural response of people's fear in the face of a pandemic when there is a tendency to make decisions with an accurate perception of health costs and benefits in individual and social terms (Bavel *et al.*, 2020).

A greater willingness to protect themselves against SARS-COV-2 seems to be positively related to married respondents and those who have children and vulnerable people at home seem to be more willing to spend. Participants fear for their health and are concerned about infecting others (Brooks *et al.*, 2020). Parents are spending an increasing number of hours taking care of their children beyond the natural precaution concerning safety against SARS-COV-2 (Sevilla and Smith, 2020). Parents have spent extra 27 hours per week on household chores, education, and childcare, however, women keep devoting longer hours on domestic duties than men, about 15 hours (Krentz *et al.*, 2020).

Considering that childcare has been provided primarily by women (Hupkau and Petrongolo, 2020), several studies have shown a massive 72% of mothers have had to work fewer hours because of childcare issues, and 65% of mothers who have been furloughed said that the lack of childcare was the reason (Krentz *et al.*, 2020). As for home office in Brazil, the data showed that the number of women who worked remotely was 16.4% higher than the number of men (8.6%). The unemployment rate among women was 15.4%, higher than that of men (11.3%) in all the country's major regions (IBGE, 2020).

The last two results found in this study reinforce the argument that the way respondents see the pandemic has an influence on their predisposition to defensive spending. For example, male respondents are less likely to make defensive expenditures, and those with health insurance plans spend a higher proportion of income on protection against the

coronavirus. In men's case, the results validate the male respondents' risk-taking behaviour (Abdulla *et al.*, 2020), commonly observed with less concern for health (Gomes, Do Nascimento, and De Araújo, 2007). Our results show that individuals who have private health insurance coverage still are more likely to spend a higher fraction of income on PPE expenditures than others. However, that result cannot be interpreted to mean that health coverage measures discourage both risk-taking or moral hazard behaviour. First, because estimating demand for health care is further complicated by the presence of a moral hazard, and the estimates of the price elasticity of their demand will incorporate the effects of moral hazard (Kaestner and Lubotsky, 2016). Second, since health insurance-income is inelastic, we believe that result is being affected by the fact that private health insurance coverage is also related to personal income.

5. CONCLUSION

This study is one of the precursors to investigate changes in consumption patterns, especially the consumption of products and services related to protection against the SARS-COV-2 Pandemic. Our main results demonstrate that women are more risk-averse and try to take more protective measures to face COVID-19 Pandemic. However, men spend a higher proportion of income than women.

The proportion spent on protection is negatively influenced by income, but positively for the case of individuals who have private health insurance, who are more likely to spend on protective measures against COVID-19 than those who do not recognize the nature of the pandemic impacts. Such fact is perceived because low-income, women, and non-white people are the most vulnerable and the most impacted ones by the Pandemic.

Other important findings of our work are related to the greater exposition to the risk. Respondents who know someone who died from Sars-CoV-2 and those who live in cities where the number of deaths from Sars-CoV-2 is higher, tend to spend more than those who do not. Our data further suggest that respondents who are responsible for other people also spend more, the ones who are married, those with children, and with people in need of care in their homes. And people with higher

risk-averse behaviour see protective measures as a way to reduce contagion by SARS-COV-2. Individuals understand their behaviour as an essential vector for combating the spread of the virus, decreasing the likelihood of infection for all members of the community and the number of deaths.

Our results seem to confirm some of the already highlighted needs for actions to combat the COVID-19 Pandemic and its consequences: Firstly, treating most vulnerable groups with special financial support. Second, to reinforce the need for clear messages about the risks of COVID-19 and finally fighting fake news and demanding cohesive actions by key sectors such as health professionals and governments. ◄

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