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Exacerbation of psychosis risk during the COVID-19 pandemic: The disproportionate impact on the lower income population

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1. Introduction

The ongoing Corona Virus Disease 2019 (COVID-19) pandemic has been an unprecedented event in human history. At the time of writing, COVID-19 counted 231 million confirmed cases and 4.7 million deaths due to the virus. Besides the many losses and the exceptional number of people infected, the pandemic has been a major challenge in several areas for nations worldwide. Public health systems struggled with sudden surges in ICU beds demand—frequently calling for difficult ethical decisions (Vincent and Creteur, 2020)—and now are facing deep transformations to adapt to this new normal (DeSalvo et al., 2021). The economy has been deeply affected, especially in developing countries, as businesses had to shut down because of quarantine measures (Rodela et al., 2020), leading to an increase in homelessness and unemployment (Flaming et al., 2021).

This tragic scenario led to the obvious suspects that a mental disorder pandemic would follow the COVID-19 pandemic. A recent review conducted by Vindegaard and Berros (Vindegaard and Berros, 2020) during the first wave of the pandemic observed a high level of post-traumatic stress disorders symptoms and a significantly high level of depressive symptoms in COVID-19 patients. According to the authors, also, non-COVID-19 patients with psychiatric disorders experienced worsening of their symptoms, health care workers had higher levels of psychiatric symptoms, and the general population's well-being significantly decreased in their observed studies. A longitudinal study in the United Kingdom—one of the countries where the pandemic hit worst—showed that mental health and well-being of the population was deeply affected (O'Connor et al., 2021). Authors make an important warning about the increasing rates of suicidal thoughts across waves of the pandemic.

Morina et al. (Morina et al., 2021) in their study observed a significant negative effect of social distancing on physical and mental health, reinforcing the importance of social connection. Negative mental health consequences are expected to affect likewise children and adolescents (Creswell et al., 2021). At last, the pandemic is also thought to influence the occurrence of psychotic symptoms (Allé and Berntsen, 2021).

Psychosis occurs at the population-level in a continuum of severity (Os et al., 2009). Most individuals have no or rare brief symptoms, and a minority present severe and persistent symptoms, constituting a half-normal distribution of such phenomena in the general population (Loch et al., 2011; Os, 2003). As this continuum is influenced by biological and environmental factors (Cosgrave et al., 2021), there is the possibility that the pandemic might have shifted it towards worse severity. Several case reports were described of new-onset psychosis since the pandemic began. They include new symptoms in otherwise healthy individuals (Correa-Palacio et al., 2020; Noone et al., 2020; Rentero et al., 2020), as well as the beginning of psychotic features in individuals with previously diagnosed mental illnesses (Fischer et al., 2020; Huarcaya-Victoria et al., 2020). These case-reports are mostly described in post-COVID-19 individuals, but studies show psychosis also increased in the non-infected population (Allé and Berntsen, 2021). The pandemic, thus, could constitute a major psychological impact for individuals through several mechanisms, such as the increased social adversity reflected in increased loneliness, and the higher unemployment and homelessness rates cited before. Additionally, many advocate that the coronavirus itself could generate post-viral psychosis, emphasizing the inflammatory viral hypothesis of schizophrenia pathophysiology (Watson et al., 2021).

Despite all this evidence pointing to a possible increase in psychosis

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cases due to the pandemic, up until now there have been no community surveys addressing this specific issue. Considering the potential of psychosis to be disruptive, it would be important to assess if the current pandemic increased the level of psychotic experiences in the general population. Furthermore, given the economic impact of the pandemic, it would also be imperative to evaluate if the pandemic differentially affected these psychotic experiences according to socioeconomic status—allowing for targeted mental health initiatives. Our study aims to evaluate the expression of psychosis in the general population and compare it to a previous sample recruited before the pandemic, and to evaluate if there is any differential effect of socioeconomic status (SES) on psychotic experiences.

2. Methods

2.1. Sample

This is part of the Subclinical Symptoms and Psychosis Prodrome Project (SSAPP), a study aimed to gather a cohort of individuals in ‘at risk mental state’ (ARMS). This work encompasses the second wave of recruitment (2020), and its comparison with the first recruitment wave (2016).

As for the first wave, a household survey was conducted in the general population of São Paulo, Brazil, the most populous city of Latin America with 12 million inhabitants. Households in all regions of the city were randomly chosen according to the probability proportionate to size (PPS) method, according to populational conglomerate of the city. Between February and March 2016, interviewers searched for individuals between 18 and 30 years of age in the selected households. Quotas according to the city’s demographical characteristics for this age stratum were established, and the research team oversaw filling these quotas for each conglomerate. Participating individuals signed an informed consent form and face-to-face interviews were conducted by trained lay interviewers from a renowned international research enterprise (Ipsos). Further details are described elsewhere (Loch et al., 2017). This first sample comprised 1950 individuals.

The second and current wave was also performed in the city of Sao Paulo, but 4 years later, in September 2020. Due to the COVID-19 pandemic procedures could not be conducted face-to-face and we opted to conduct a CATI (computer assisted telephone interview) survey. A specialized research company was hired, and a random phone number generator was used to recruit the sample. Twenty interviewers screened 2500 individuals with 18 to 35 years of age. To balance for possible distortions in the composition of this second sample, subjects’ responses were weighted according to age and sex based on the Household Sample National Survey—National Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, 2021). Of those, 1804 were aged between 18 and 30 years and composed the analyzed sample of the current study.

The project was approved by the Ethics Committee of the Faculty of Medicine, University of Sao Paulo. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

2.2. Sociodemographic data

Sociodemographic data comprised age, sex, years of education, and socioeconomic status (SES). The latter was classified into classes according to the IBGE (Instituto Brasileiro de Geografia e Estatística, 2021). These socioeconomic classes are based on family income. However, according to the Brazilian Association of Research Enterprises (www.abep.org), the referred income may differ from actual income in community surveys. As such, all enterprises use as a proxy scoring system that takes considers house and neighborhood infrastructure (paved streets, piped water, number of bathrooms in the household, presence of

housekeeper (s) etc.), as well as family’s patrimony (number of cars, televisions, refrigerators, etc.) to rank individuals into IBGE’s socioeconomic classes.

2.3. Clinical assessments

Both 2020 and 2016 interviews used the Prodromal Questionnaire (PQ) (Loewy et al., 2005), but different versions of it. While the 2016 assessment used the full 92-items version of the PQ, the 2020 assessment used the PQ-16 (Ising et al., 2012) combined with a basic symptom scale, as recommended by previous work (McDonald et al., 2019). The PQ in its full version is a self-report questionnaire with 92 true or false items on prodromal symptoms of psychosis. Items are grouped in four distinct dimensions: positive symptoms ($N = 45$), negative symptoms ($N = 19$), disorganized symptoms ($N = 13$) and general symptoms ($N = 15$). It was also validated and made available in Portuguese (Gonçalves et al., 2012). As for the PQ-16, to increase efficacy/accuracy and to reduce interview time, it consists in only 16 true or false items, extracted from the positive symptoms of the full PQ—plus evaluation of the distress caused by the rated experience (Loewy et al., 2011).

For the present comparison analysis, we considered the sum of the PQ-16 scores from the 2020 survey (yes=1 and no=0). In order for the 2016 survey to be comparable, we extracted the participants’ scores from the 16 items of the full PQ that matched the PQ-16 version, and summed these scores (yes=1 and no=0). These equivalent scores will be referred to as simply “PQ” from this point onwards. For analytical purposes, the cut off score was set to 6 or higher, according to authors who developed the scale (Ising et al., 2012).

For the 2020 survey, additional questions were made: 1) if they had ever sought any professional help because of mental health issues, 2) if they had already been prescribed any psychiatric medication, and 3) if they were currently under psychiatric treatment. As mentioned, for each PQ item of the 2020 survey, level of distress related to that experience was scored in a scale of 0 (no distress) to 3 (great distress).

2.4. Statistical analysis

Generalized linear models (GLMs) were performed with PQ scores as the response/dependent variable. Two modeling were adopted: GLM 1, with current data, from the 2020 survey. And GLM 2, which was conducted with 2020 and 2016 data pooled.

GLM Parameters: Distribution of PQ scores was not normal according to Shapiro-Wilk and Kolmogorov Smirnov analysis ($p < 0.001$). Instead, visual inspection of data showed a half-normal distribution. As such, response in the GLM was set as gamma with log link distribution, with main effects analysis.

GLM independent variables: Bivariate analysis (chi-square or independent-samples Kruskal-Wallis test) between PQ scores and demographic data showed that age, socioeconomic status (SES), and years of education significantly influenced PQ scores. Accordingly, GLM 1 included these variables as predictors. In GLM 2, data from the 2016 and 2020 surveys were pooled together, and year of the survey (2020 vs 2016) was added as a predictor.

At last, independent-samples Kruskal-Wallis test was performed to compare mean PQ scores in the 2016 and in the 2020 samples, according to SES.

In all analyses, 2020 scores were weighted according to sex and age to counter for possible differences due to different methodology. Significance was adopted as bicaudal at a $p < 0.05$ level. All analyses were performed with SPSS 25.0 for Mac.

3. Results

Most individuals above the proposed cut off point of the PQ were not under psychiatric treatment (89%) (Table 1). They also displayed a statistically significant higher mean level of distress related to their

psychotic experiences, compared to those below the threshold (1.566 vs. 0.932, respectively; $p < 0.001$).

Table 1

In, generalized linear model 1 of PQ scores vs. predictors (GLM 1), age showed a significant correlation, indicating that the lower the age the higher the PQ score (Table 2). SES also showed a significant correlation, in the sense that the lower the income the higher the probability of increased PQ scores. In GLM 2, age and low income again showed significant correlation to PQ scores, but also level of education and year of the survey appeared as significant predictors.

Mean PQ scores significantly increased from 2016 to 2020 ($p < 0.001$), as graphically displayed in Fig. 1. When analyzed by level of SES, except for the high-income stratum, all socioeconomic classes showed a statistically significant increase in their PQ scores after the pandemic ($p < 0.001$) (Table 3). Within year analysis also show that individuals in the lower income strata scored higher in the PQ than those with higher income, both in 2016 and in 2020 ($p < 0.001$).

4. Discussion

To the best of our knowledge, this is the first study to analyze the psychosis continuum in the general population before and after the COVID-19 pandemic. Our results show that the distribution of the continuum was shifted to the right, with individuals generally endorsing more items after the pandemic. This increase was statistically significant for all socioeconomic classes except for the high-income stratum. Both for 2016 and for 2020, the less the income the higher the score in the PQ-16—individuals in the lowest income stratum scoring the highest. Lower age and lower level of education also increased PQ scores. Individuals above the PQ-16 threshold were mostly not under treatment, despite their higher level of distress related to their psychotic experiences.

Our results are in line with those of the literature, showing that the pandemic generated an increase in common mental disorders (Robillard et al., 2021; Salari et al., 2020), but also in psychotic symptoms (Brown et al., 2020). More specifically, there is one study conducted in Italy describing a 29.6% increase in psychiatric hospitalizations for incident cases of psychosis as compared to before the pandemic—i.e., 2020 vs. 2019 (Esposito et al., 2021).

This observed shift in the psychosis continuum in our study could be due to some factors. First, and most importantly, it is well known that environmental factors influence the expression of psychosis in the general population (Spauwen et al., 2004). As such, the COVID pandemic constitute an important environmental stressor by means of the adverse psychological effects of social distancing, concerns about unemployment, fear of contamination, and grief about the lost ones (Eisma et al., 2021; Qiu et al., 2020; Yao and Wu, 2021). Second, post viral exposure psychosis has been reported since the Spanish flu, with acute “psychoses of influenza” being documented during multiple pandemics (Kepińska et al., 2020). This is not different for the COVID pandemic, and several

Table 1
Sample characteristics.

	2020n = 1804
Age (mean, SD)	24.4 (3.36)
Sex (male; n,%)	904 (50.1%)
Marital status (single; n,%)	1544 (85.6%)
Employed (yes; n,%)	1378 (76.4%)
Years of education (mean, SD)	11.62 (64.3%)
Socioeconomic class (middle-income; n,%)	740 (41.0%)
BS score (mean, SD)	4.21 (2.21)
Prodromal Questionnaire score (mean, SD)	5.62 (3.64)
Above Prodromal Questionnaire cut off (n,%)	832 (46%)
... and never sought professional help	65% (540)
... and never received psychiatric medication	77.5% (645)
... and are currently under psychiatric treatment	11% (95)
Level of distress of symptoms: above cut off (mean,SD)	1.566 (0.62)
below cut off (mean, SD)	0.963 (0.76)

Table 2
Generalized linear models of Prodromal Questionnaire scores vs. predictors.

Model 1 (2020)	B	Exp (B)	95%CI	p
Age	-0.024	0.97	(0.968–0.986)	<0.001
Socioeconomic status	(0.01)	-	-	-
High income	ref.	1.142	(0.968–1.347)	0.115
Upper-middle income	0.133	1.193	(1.025–1.388)	0.023
Lower-middle income	0.176	1.250	(1.082–1.444)	0.002
Low income	0.223			
Years of education <13	ref.	-	-	-
13+	-0.044	0.957	(0.897–1.020)	0.178
Model 2 (2016)				
Age	-0.018	0.98	(0.976–0.988)	<0.001
Socioeconomic status	(0.01)	-	-	-
High income	ref.	1.026		0.652
Upper-middle income	0.026	1.105	(0.917–1.291)	0.072
Lower-middle income	0.100	1.154		0.012
Low income	0.144		(0.991–1.232)	
			(1.032–1.291)	
Years of education <13	ref.	-	-	-
13+	-0.093	0.912	(0.869–0.957)	<0.001
Year 2016	ref.	-	-	-
2020	0.140	1.097	(1.045–1.151)	<0.001

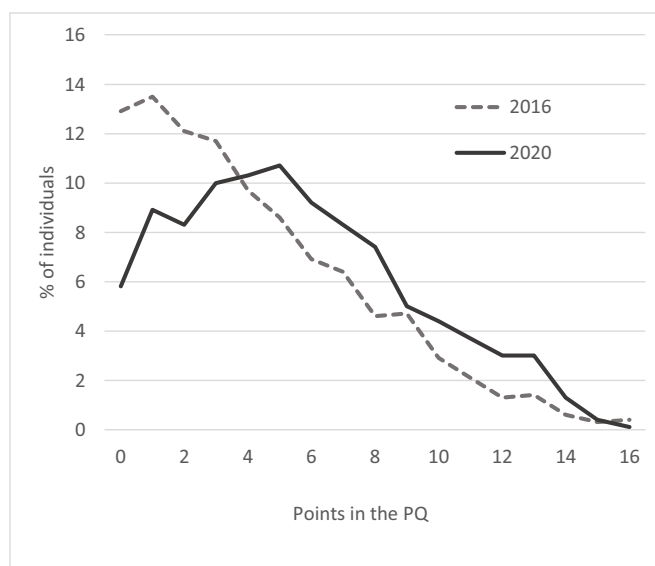


Fig. 1. Prodromal Questionnaire (PQ) scores in 2016 and in 2020.

Table 3
Mean Prodromal Questionnaire score according to socioeconomic class.

Socioeconomic class	PQ score – Mean (SD)*		Variation between years	p
	2016 surveyn = 1950	2020 surveyn = 1804		
High income	3.96 (3.63)	4.34 (3.64)	9.5%	0.525
Middle upper income	3.69 (3.30)	5.08 (3.42)	37.7%	<0.001
Middle low income	4.48 (3.50)	5.60 (3.51)	25.0%	<0.001
Low income	4.94 (3.82)	6.07 (3.83)	22.8%	<0.001

* Score range: min=0, max=16.

cases of new-onset psychosis after coronavirus infection were described up until now (Alba et al., 2021; D'Agostino et al., 2021; Parker et al., 2021), reinforcing the hypothesis of the viral origin of schizophrenia (DeLisi, 2021; Kulaga and Miller, 2021).

As for the disproportionate effects of the pandemic, previous studies already showed that socially and economically deprived individuals are at a higher odds of having a poorer outcome of the infection (Patel et al., 2020), showing also increased mortality rates (Zelner et al., 2021). This would be due to an accumulation of risk factors in this population, such as living in an overcrowded accommodation, being employed in an occupation that does not provide the opportunity to work from home, and presenting themselves to healthcare services at a more advanced stage of the illness (Patel et al., 2020). This trend regarding the viral infection seems to repeat itself for the consequential “mental illness pandemic” (Li et al., 2021), showing that the assertion “COVID-19 does not discriminate” should be relativized.

Studies on this issue are rarer, but one investigation in Austria found evidence that levels of depression and anxiety had increased more dramatically in lower income populations since the pandemic began (Pieh et al., 2020). In another one in an Indian population, lower SES was a risk factor for greater stress, depression and anxiety (Kajdy et al., 2020). Considering that lower income has been associated with worse psychopathology during COVID-19 (Jaspal and Breakwell, 2020), on a more macroscopic perspective a large study enrolled 11,227 individuals from 30 countries (Maffly-Kipp et al., 2021). They concluded that mental health disparities are greater in countries with more severe COVID-19 outbreaks—which is the case of Brazil. As such, our results add up to the previous findings, reinforcing the idea that people with low SES are at a higher risk of developing psychiatric symptoms—in our case, also psychotic symptoms.

Lower age was also related to an increased score in the PQ scale in our study. This replicates previous surveys in the general population, showing that specific demographic characteristics—such as younger age—are related to psychosis (Os et al., 2009). There is, also the possibility that in older ages such symptoms might have already remitted (Michel et al., 2018). Our finding of lower education being related to a higher PQ score also reflects the literature, since low-level scholastic achievement has been associated with the risk of developing schizophrenia spectrum disorders (MacCabe et al., 2008).

Our study has some limitations. Regarding the comparison analysis, due to the pandemic the same design of 2016 could not be repeated. Because of quarantine and social isolation, a face-to-face interview approach would deem inappropriate, and the best way to reach more people was doing a telephone survey. To control for a possible distortion, we adopted the generalized linear models including sociodemographic variables to minimize hypothetical selection biases. Also, previous studies in Brazil addressed the issue of potential bias in epidemiological surveys conducted by telephone, in which authors recommend such designs only in places where telephone coverage is above 70% of the population (Bernal and Silva, 2009). As the city of Sao Paulo has an internet and telephone coverage of 79.7%, we would expect less bias in the results. Despite all of this, the comparison results still should be interpreted with caution. Another limitation of our study is that we were not able to gather further data on psychopathology from participants. As a populational survey enrolling 1804 individuals in one month, and using lay interviewers, this was logistically impossible and constitutes a caveat of our design.

Our study brings important findings, which should inform public policy makers to target the less socioeconomically favored individuals for mental health initiatives—especially because in our results individuals with more symptoms are more distressed and mostly not under treatment. Biologically speaking, the SARS-CoV-2 does not discriminate, it does not choose people based on their income. However, people with lower SES concentrate more risk factors for a worse biological outcome of the COVID. And we are seeing now that they also concentrate more risk factors for a worse mental health outcome of the pandemic at large.

As psychosis can be faced as an unspecific marker of mental distress (Loch, 2019), one would expect a pandemic of mental disorders in the coming months. The scenario is even worse if we consider that COVID greatly affected the economy of countries worldwide—especially in LAMIC (Bargain and Aminjonov, 2021)—emphasizing the poverty risk factor. We will depend on the population resilience and tough public health initiatives in order not to witness a subsequent mental health pandemic. Future studies should address the longitudinal course of such increase in population's psychopathology.

Funding sources

This work was supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP grant#2014/50873-3) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq grant# 565412/2014-9). The sponsors had no influence on the design of the study; on the collection, analysis and interpretation of data; on the writing of the manuscript; or on the decision to submit the manuscript for publication.

CRedit authorship contribution statement

Alexandre Andrade Loch: Conceptualization, Formal analysis, Funding acquisition, Writing – original draft, Writing – review & editing. **Natália Bezerra Mota:** Writing – original draft, Writing – review & editing. **Wulf Rössler:** Conceptualization, Writing – review & editing. **Wagner Farid Gattaz:** Conceptualization, Funding acquisition, Writing – review & editing.

Conflict of Interest

Authors declare there are no conflict of interest.

Acknowledgement

The Laboratory of Neuroscience LIM27 receives financial support from the Associação Beneficente Alzira Denise Hertzog da Silva.

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