Sociodemographic Differences in COVID-19 Self-Reported Symptoms by Ethnicity and Older Adults in Bolivia

Vladimir Pinto Saravia[1] (ORCID)

Abstract

The effects of COVID-19 revealed the fragility of health systems in the LAC region, with greater risk of death in older people than in younger people, as well as greater vulnerability to infection due to living with people aged 30–59 years, who have a higher prevalence of COVID-19. On the other hand, there is not much information on inequalities in the incidence of COVID-19 in indigenous people, a population with lower immunological resistance. The objectives are: 1) To determine the association between sociodemographic variables with self-reported COVID-19 symptoms. 2) To investigate whether this relationship shows inequalities by ethnicity and age. For that purpose I conducted a cross-sectional analysis using the 2020 Household Survey and investigated the association between sociodemographic variables and self -reported COVID-19 symptoms and explore the contribution of factors such as employment type, household living arrangements, years of education, age, ethnicity, gender, current status of working and residence area. I performed bivariate analysis to establish trends. Subsequently using logistic regressions to establish the risks to self-reported COVID-19 symptoms. A fully interacted model is analysed by ethnicity. I found those who were living alone were less likely than those living in a Couple with/without relatives' household arrangement to self-reported COVID-19 symptoms (OR = 0.79, 95% CI: 0.66–0.94, p < .01). Odds of the older persons aged 45–59 (OR = 1.44, 95% CI: 1.27–1.62, p < .05) were relatively more likely than younger people (OR = 1.19, 95% CI: 1.05–1.35, p < .01). Indigenous living in a couple with/without children household arrangement were less likely than non-Indigenous (OR = 0.75, 95% CI: 0.62–0.90, p < .01). Odds of Indigenous people of age 30–44 (OR = 1.26, 95% CI: 1.04–1.53, p < .01) were more likely than non-Indigenous. Odds of Indigenous persons of age 45–59 (OR = 1.59, 95% CI: 1.32–1.91, p < .05) were more likely than non-Indigenous (OR = 1.32, 95% CI: 1.12–1.55, p < .01). As conclusions, 45–59 age group shows higher risk factors and those aged 60 + show lower risks. These are increased in people working in managerial, administrative and professional, and technical positions, those living in a household with/without relatives, men, those living in urban areas, and/or non-indigenous people.

Keywords Inequality · Aging · Ethnicity · Bolivia · COVID-19

Extended author information available on the last page of the article

Springer

Introduction

On December 31, 2019, the World Health Organization (WHO) detects a communication from the Wuhan Municipal Health Commission (People's Republic of China) about the appearance of cases of 'viral pneumonia of unknown origin', which will later be determined to be caused by a new coronavirus Sars-CoV2 and which will later be known as COVID-19, affecting the world population, unleashing a new world pandemic after those suffered in the twentieth century, such as the Spanish Flu (1918), HIV (1980) and influenza A-H1N1 (2009) -first of the twenty-first century-. The COVID-19 pandemic, at the beginning of March 2022, was estimated to cause around six million deaths worldwide, lower than the Spanish flu (50–100 million) and HIV (36 million) but higher than A-H1N1 (half a million) (Castañeda Gullot & Ramos Serpa, 2020; Johns Hopkins University, 2022). Between the end of February and March 2020, COVID-19 cases were reported in Latin American countries, including Bolivia.

As of 2020, the world faces one of the worst health situations and high mortality rates seen in this century. This already complicated situation in Latin America is aggravated by high levels of inequality and poverty, which constitute social and demographic vulnerability factors that affect the impact of the COVID-19 pandemic (Canales, 2021).

In this pandemic context, countries implemented health measures led by the World Health Organization (WHO, 2020b), but the elaboration of policies and their implementation was conducted in a heterogeneous manner as observed in the Observatory of COVID-19 in Latin America and the Caribbean (ECLAC, 2020). As can be seen, the design of these policies is developed under the assumption that the population is homogeneous and that the effect of COVID-19 is the same throughout the population, but it is important to consider that in the region, on the one hand, an advanced aging process is observed in most countries of the region, reaching 9% of people aged 65 + in 2020, and it is estimated to reach 12% of the population in 2030. In addition, there is an increase in the population aged 35–64 years (34% in 2020 to 38% in 2030) and a decrease in the population aged 0–34 years (56% in 2020 to 50% in 2030). Older adults faced a higher risk of dead, with a 12 times higher probability of dying than persons in the 40–59 age. Also, many of the older adults living in precarious households usually live in close rooms with people aged 30–59, who have higher prevalence of COVID-19 (Paz, 2020).

On the other hand, in the region the indigenous population is heterogeneous, with the average percentage of the indigenous population calculated to be 9.8% in 2018 and to reach more than 58 million. The countries with the highest percentage of the indigenous population are Guatemala (43.6%) and Bolivia (41.5%). In addition, this population is the one with the greatest social deprivation and the lowest economic income, placing them in a situation of greater vulnerability. The work done to reduce inequality in the region is well documented, driven since 2000 by the agenda of the Millennium Development Goals—MDGs—and since 2015 by the Sustainable Development Goals—SDGs, but all these advances could fade as the Covid-19 pandemic.

Available data on racial disparities in COVID-19 incidence and mortality are currently limited but expanding. Various community representatives, human rights organisations, and researchers have maintained that indigenous populations are among the most vulnerable groups to the pandemic and that COVID-19 could have catastrophic effects on their life systems. It's important to mention that "the immune profile of indigenous populations can also differ from those of the majority populations living in the same region [LAC]. Response to a new virus and disease may therefore be unexpected and even deadlier among such minority group" (Mesa Vieira et al., 2020, p. 39). As stated in the Declaration on the Rights of Indigenous Peoples, this population have the right to health, among others, more visible with the COVID-19 pandemic, "however, in LAC this objective is affected and far from being achieved since as mentioned above the living situation of indigenous peoples is generally precarious; in addition, the lack of information about these populations makes it difficult to implement the mitigation programmes offered by the government, as well as to implement the measures proposed by each of the communities" (Flores-Ramírez et al., 2021, p. 991).

This paper intends to contribute with evidence to a) determine the association between sociodemographic variables with self-reported COVID-19 symptoms; and b) To investigate whether this relationship shows inequalities by ethnicity and age.

Background and Literature Review

Since the middle of the last century, studies about inequality have focused on the relationship between poverty and inequality (Grusky, 2018) and there is no collective decision to undertake the known institutional reforms necessary to reduce them (Grusky & Weisshaar, 2014). Inequality in Latin America in the twenty-first century has decreased, in part due to the equalization of indigenous peoples, women, and Afro-descendants (Therborn, 2016). It is also important to mention that the conception of inequalities, as a social construct, is differentiated depending on who develops it (Berger and Luckmann, 1968).

Regarding older persons and the COVID-19 framework, although the median age of confirmed cases is 51 years, the case fatality rate for those older than 80 years is five times higher than the global average (United Nations, 2020; OMS, 2020). Likewise, advanced age in the degree of evolution of population aging becomes a risk factor, due to chronic diseases and health determinants associated with higher risk, such as home arrangements and co-residence influence the determinants of population health (CELADE, 2020).

Priority should be given to the welfare of the poorest and most vulnerable people in society to minimize the impact of epidemiological and economic externalities, as well as social and political risks, ensuring access to income, food, and health care in the short term, and in the medium term, ensuring connectivity so that poor children can recover lost schooling and do not drop out of school (Lustig & Tommasi, 2020). Also, educational attainment was associated with staying at home (Irigoyen-Camacho et al., 2020).

As well, as "possible increases in unintended pregnancies, mental health challenges, and domestic violence or worsening of chronic conditions due to overburdened health systems" (Garcia et al., 2020, p. 1771). In terms of differences in the effect of the COVID-19 pandemic, older persons living in the U.S. reported a greater economic impact. Latinos living in the U.S. and those from Chile, Mexico, and Peru reported a greater impact of the pandemic, and Latinos from Argentina, Chile, and Peru reported less discrimination (Babulal et al., 2021). Regarding income inequalities, "coverage and replacement rates of usual labour income are high among the first quintile of the population but fairly low in the second and third quintiles, where a substantial fraction of households are informal and have limited ability to telework" (Busso et al., 2020). Likewise, a high correlation is observed between responses to the pandemic and the access of elites to government, in addition to their ethnicity (Martínez & Sánchez—Ancochea, 2020).

Among indigenous populations, particular attention should be focused on indigenous communities in isolation, given their lower immune resistance, lack of access to hospital care, and the increasing penetration of extractive activities in their territories (Avila & Guerena, 2020). Likewise, the lack of access of indigenous peoples to health services is linked to geographic obstacles, discrimination, stigma, and importantly lack of social understanding. But they are also often of lower quality than those received by other groups and are not always culturally acceptable to these indigenous people (OPS, 2015).

Regarding the employment, during the COVID-19 pandemic in Peru, the risk was determined according to occupation and other associated factors for posttraumatic stress, and differences were found by type of occupation, with the unemployed being the most affected, followed by people who perform domestic work, and the least affected were those who perform education, transportation, health, and financial activities. (Mejia et al., 2020). On the other hand, in Mexico, it is observed that skilled workers have suffered less from the crisis generated by COVID-19, compared to people in less qualified sectors (Nájera & Huffman, 2020). Also, it is observed that in poor Bolivian municipalities, with an indigenous population and nutritional problems, they are not so prone to suffer arterial hypertension or diabetes, probably the type of occupation, usually in the agricultural sector, does not facilitate the development of these diseases (Eyzaguirre & Olivera, 2020). On the other hand, the results of a Colombian study related to self-care actions and social distancing in the face of the COVID-19 pandemic show a significant relationship between social distancing practices and the level of academic education of the participants (Campechano-Escalona & Cuasialpud Canchala, 2021).

Regarding the household living arrangements, the results of Mexican studies analysing the socioeconomic and family characteristics of people aged 50 years or older who are at high risk of testing positive for Covid-19, being hospitalized or intubated, show that people aged 50 years or older living in unipersonal households, among other sociodemographic variables, are presented as a group highly vulnerable to COVID-19 and its repercussions(González-González et al., 2021; Welti-Chan

& Ramírez-Penagos, 2021). Similarly, in the Brazilian context, older persons living alone were more likely to report COVID-19 symptoms (Andrade et al., 2022).

Three or more people per dormitory make it difficult for the family to apply hygiene and isolation measures, presenting a greater possibility of contagion (Oxfam, 2020). Likewise, greater exposure to violence, abuse, and neglect can be observed in older persons who spend quarantine or confinement with relatives or caregivers (Naciones Unidas, 2020).

Regarding the attained education, in general, the differentiated educational responses of the various countries in the region show challenges at the time of implementing measures to ensure continuity, equity, and inclusion, while maintaining distance learning. These challenges, in terms of equity and inclusion, should focus on the most vulnerable population groups (indigenous peoples, Afro-descendants, refugees, migrants, socioeconomically disadvantaged populations, people with disabilities), as well as sexual and gender diversity (Kemet & Paul, 2021).

It is also important to mention that an association was found between educational level and knowledge of COVID-19 symptoms (Irigoyen-Camacho et al., 2020). People aged 50 and over with less schooling are presented as a group highly vulnerable to COVID-19 and its repercussions (González-González et al., 2021). Regarding noncommunicable diseases, in Bolivia, it is observed that higher levels of education reverse the inequality of hypertension and diabetes, with greater relevance in the case of hypertension (Eyzaguirre & Olivera, 2020).

Bolivian Context

According to the last population census of 2012, the total population was 10 059 856, of which 8.7% (878 012) is 60+, 59.9% (669 009) corresponds to 15–59 and 31.4% (3 160 766) to 0–14. Of the total 60+population, 52.8% (463,904) are indigenous and the remaining 47.2% (414,108) are non-indigenous. There are unfavorable educational gaps to indigenous people, where people 50+reach 4.1 years of study, unlike non-indigenous people reach 8.2 years of study. In addition, it was observed that in 2018, 74.8% of the indigenous population was in poverty, unlike the non-indigenous population, which reached 39.9%.

On March 11, 2020, in a press conference, the Minister of Health confirmed the first two cases of the SARS-CoV-2 coronavirus (COVID-19) in Bolivian territory, being one of the last countries in Latin America to register its first coronavirus cases. One of the cases was a 65-year-old woman. To date (February 9, 2022), according to the Bolivian Ministry of Health, there are 878,922 confirmed cases of covid-19, with 21,219 deaths. The case fatality rate is 0.8% in the fourth wave (6.2% in the 1st wave, 2.7% in the 2nd wave, and 2.5% in the 3rd wave). Although the Ministry of Health monitored the number of infected cases and deaths due to COVID-19, disaggregated by the 9 departments, there is no accessible information disaggregated by age or sex, which is necessary for monitoring and developing health measures in accordance with the affected population.

The outbreak of the COVID-19 pandemic in Bolivia, developed in a complicated political context in which, in addition to an evident lack of investment

in the health sector, it was crossed by a strong social crisis because the party that governed for 14 years became the opposition due to the annulment of the elections held in October 2019, resulting in the resignation of Evo Morales and the proclamation of Jeanine Añez as president of the transitional government in charge of carrying out new elections as soon as possible (Chumacero, 2019; Molina, 2019; Stefanoni, 2019; Wolff, 2020), going through oxygen shortages due to road blockades (Ministerio de Salud y Deportes, 2020) and, as the executive director of the Foundation for Journalism in La Paz, Renan Estenssoro, mentioned: "The MAS party politicized the pandemic. They said that the virus was an invention of the right-wing interim government. That is why people took to the streets again" (Pieper, 2020). In this context, the first part of the management of the pandemic was carried out by a transitional government, and from October 2020 the new government takes over.

The prevalence of dementia among older adults during COVID-19 shows a significant increase in Latin America (15.6%) and Bolivia (28.5%), attributable to a constellation of ethnic, demographic, and socioeconomic factors (Soto-Añari et al., 2021). As well, a high proportion of the Bolivian population is affected by unequal, precarious working conditions, and poverty (Hummel et al., 2021) The impact of COVID-19 disease can be seen to be producing income transfers to the upper classes and certain changes in the elite level in the region (Bull & Robles Rivera, 2020).

In a study of people who attended a laboratory in Santa Cruz (Bolivia), men and women aged 41 to 60 years presented a greater number of comorbidities, verifying the infection independently of age, sex, and the number of associated comorbidities present. Although comorbidities in persons over 40 years of age increase the risk (even more in men and with diabetes) (Taboada et al., 2021). On the other hand, in a simulation analysing the dynamics of infection three weeks after the declaration of quarantine, the measures imposed show that the speed of infection decreased from $R0=6$ to $R0=2.4$ (Birbuet & López, 2020) The groups at greatest risk of contracting and dying from the disease are older persons over 65 years of age and those with underlying diseases, including non-communicable diseases (NCDs) (Eyzaguirre & Olivera, 2020). On the other hand, the elderly population deprived of liberty is prone to a rapid spread of the virus (Reyes García, 2020).

In addition, most households in Bolivia can protect themselves from the virus with at least five of the 6 basic protection recommendations suggested by the WHO, and in urban areas of the country, the recommendations for protection from external shocks such as COVID-19 are more favourable than in rural areas. On the other hand, age and chronic health conditions of people make them more vulnerable to the presence of COVID-19 (Reyes Dorado Gutiérrez, 2022). The pandemic has disproportionately harmed unsalaried workers and their families. In addition, overcrowding makes it impossible to maintain distance between family members (Hummel et al., 2020).

On the other hand, how each child and adolescent faces confinement is conditioned by the socioeconomic inequalities of the families. Inequalities in the coverage of basic services such as drinking water, sewage, and electricity are also evident in rural areas, which has an impact on the proposed security measures (Tito et al., 2020).

The health crisis further aggravates the conditions of vulnerability and social exclusion of indigenous populations, with extreme poverty rates, triple those of the

rest of the Latin American population, characterized by shortages of basic supplies and the impossibility of accessing COVID-19 diagnostic tests, insufficient number of beds available in hospitals and health care centers located in regions with high percentages of the indigenous population in several countries of the region, such as Bolivia, Ecuador, Honduras, Mexico, Nicaragua, and Peru (OEA, 2020). Furthermore, the inequalities deepened by the pandemic reflected the special impact on indigenous women and girls living in rural areas (Dreon, 2021).

The indigenous population in the region is heterogeneous. ECLAC (2020) estimates that the average percentage of the indigenous population in the LAC region was 9.8% and estimated that in 2018 it would reach 58,180,000. Guatemala and Bolivia are the countries with the highest relative weight of indigenous population, 43.6%, and 41.5%, respectively. In contrast, Brazil and El Salvador show the lowest percentages of the indigenous population, 0.5%, and 0.2%, respectively (Map 1).

There is also heterogeneity among the more than 800 indigenous peoples recognized in the region. On the one hand, the number of indigenous groups in each country is unequal. Brazil has 305 indigenous peoples, followed by Colombia (102) and Mexico (78). In contrast, the countries with few indigenous peoples are Costa Rica and Panama (9), El Salvador (3), and Uruguay (2). On the other hand, the size of the population varies greatly. In Chile, the Mapuche people reach 1.75 million (82.4% of the indigenous population); this is followed by the Aymara people with a population of 156,754 people (7.4% of the total indigenous population), to mention a few cases.

Based on the population pyramids, three groups can be observed: (i) Structure of the indigenous population notoriously younger than the non-indigenous (Brazil, Colombia, Panama, and Venezuela), in which the non-indigenous population is in a more advanced aging process; (ii) Structure of the indigenous population young, but with little difference to the non-indigenous population, Ecuador, Guatemala and Honduras and, (iii) Structures of the indigenous population do not differ from those of the non-indigenous population, or are older than the non-indigenous population, Argentina, Bolivia, Chile, Costa Rica and Uruguay (ECLAC & FILAC, 2020).

Data and Methods

Data

The results presented in this study are based on data gathered in the context of the latest Households survey of the National Institute of Statistics of Bolivia for 2020. The sample design for the survey has the characteristics of a probabilistic, clustered, stratified, and two-stage sample, representative at national level. The basic units of the research are occupied private households. The sample size determined for the survey was 11 292 households and 37 092 cases.[1] Data collection took place

---

[1] Total: 30–44 years old = 7 495 cases; 45–59 years old = 5 167 cases; 60 + years old = 4 248 cases.
Indigenous: 30–44 years old = 2 661 cases; 45–59 years old = 2 322 cases; 60 + years old = 2 292 cases.
Non-indigenous: 30–44 years old = 4 834 cases; 45–59 years old = 2 845 cases; 60 + years old = 1 956 cases.

México, 2015
21.5%
27 126 648

Honduras, 2013
7.8%
746 190

Panamá, 2010
12.3%
512 108

Colombia, 2018
4.4%
2 185 084

Guatemala, 2018
43.6%
7 513 459

El Salvador, 2013
0.2%
14 878

Venezuela, 2011
2.7%
768 743

Nicaragua, 2005
6.3%
121 024

Costa Rica,
2011
2.4%
121 024

Ecuador, 2017
7.0%
1 200 939

Brasil, 2010
0.5%
934 905

Perú, 2017
26.0%
8 305 184

Bolivia, 2012
41.5%
4 713 534

Paraguay, 2012
1.8%
126 631

Chile, 2017
12.4%
2 318 876

Uruguay, 2011
2.4%
81 092

Argentina, 2010
2.4%
1 056 063

Map 1. Latin America (17 countries): Population that identifies itself as indigenous, according to the latest census and estimates as of 2018. Source: ECLAC/FILAC, "Los pueblos indígenas de América Latina—Abya Yala y la Agenda 2030 para el Desarrollo Sostenible: tensiones y desafíos desde una perspectiva territorial", (2020, p. 154)

between November 3rd and December 22, 2020. This survey is the first to collect information regarding COVID-19, including seven questions on that matter.

At that time, the first wave was in decline, although health security measures were still being implemented in a tense political context in which a new government took over, preceding a transitional government marked by social conflicts that affected COVID-19's handling of pandemic response measures.

In Bolivia, as in the region, four waves of COVID-19 infections have been observed so far. In the first wave, when the information was collected, an estimated 144 034 confirmed cases and 8 916 deaths were reported, with an unusual peak of 290 deaths

on September 4, 2020, possibly due to the social conflicts that occurred weeks earlier, such as road blockades in various parts of the country, which concentrated many people in these events and could increase transmission among them (Fig. 1).

Dependent Variable

a) People who self-reported symptoms of COVID-19

To measure the incidence of COVID-19 in the population, the most recommendable is to use the information collected by persons confirmed by laboratory test, whose information is available in this survey showing a lower number of cases than that collected by self-reporting of COVID-19 symptoms.

Regarding the registration of cases, it was linked to diagnostic tests, in which the underreporting of cases was observed, particularly those asymptomatic (Fantin et al., 2021; Rainer Echeverría & Harumi Sueyoshi, 2020). In the Bolivian case, public investment in health was seen to drop to 3.7% in 2017, being the country with the lowest current health expenditure per capita per year of South American countries, showing the health system on the verge of collapse, a context in which COVID-19 was developed and the implementation of improvised measures related to social demands rather than health strategies, directly affecting in the lifting of cases by COVID-19 (Salazar & Rocha, 2020).

As mentioned before, the social conflicts in Bolivia that accompanied the pandemic became one of the reasons that people could not go to health centers for testing, and the supply of reagents for testing was irregular, both because of the social conflicts and the high global demand. Also, given that the health system was
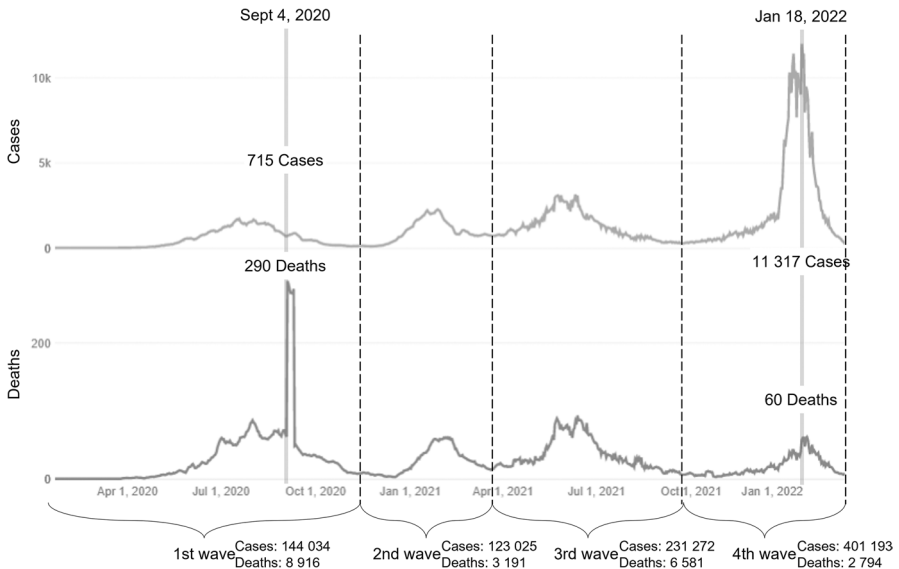

Fig. 1 Bolivia: COVID-19 number of cases and deaths. Source: Johns Hopkins University & Medicine, Coronavirus Resource Center, 2022, https://coronavirus.jhu.edu/

collapsed (as in most of the region), delays were observed in the delivery of results. Thus, this measurement resulted in underreporting of cases.

On the other hand, self-reporting of symptoms can be used as a proxy to measure the incidence of COVID-19. At the beginning of the pandemic, WHO recommended the application of this measure for the prevention of cases (WHO, 2020a). Regarding the use of self-reported symptoms in the context of COVID-19, there are few studies, for Koehlmoos et al. (2020) self-reported symptom tracking proved to be beneficial for tracking and monitoring the spread and progression of influenza, experience that applies in this pandemic. It was also noted that tracking self-reported symptoms helps to identify new COVID-19 symptoms and to estimate the predictive value of certain symptoms (Menni et al., 2020; Zens et al., 2020) and to identify individuals requiring immediate clinical evaluations (Bastiani et al., 2021). Some examples, such as in the UK, which developed an app that collects information from smart watches (Quer et al., 2021) and others, in which they respond periodically (Williams et al., 2020), as well as tracking self-reporting of symptoms in individuals who post their daily symptoms on twitter (Sarker et al., 2020). Finally, for Oliver et al. (2020) it states that large-scale online surveys can be an effective, inexpensive, and rapid tool for assessing the impact and prevalence of an infectious disease in the context of a pandemic, especially when there is a lack of official data and limited capacity for analysis.

However, the information coming from self-reporting could be overrepresented, because people who do not have symptoms may report any when asked, could be related to the theory of social exclusion (Leary, 1990), so as not to be excluded from access to health services (Bejaković et al., 2021; D'cruz & Banerjee, 2020) and to lack of social contact and ignorance of behavior in case of being infected by COVID-19 (Aslan & Kant, 2022).

Considering these aspects, the variable to be explained is the persons who self-reported COVID-19 symptoms in 2020. For the construction of this variable, the question "In this year 2020, did you present symptoms of COVID 19[2]?" was used, with the answer $1 = $ Yes, $2 = $ No, and was applied to each member of the household. This variable was asked of all persons aged 12 years or older, members of the household, and the purpose is to have a diagnosis of the number of persons who self-reported COVID-19 symptoms. This variable is dichotomous and was recoded as 1 for people who answered positively, and 0 for people who answered negatively.

Independent Variables

Although there is no statistical model developed in the context of the COVID-19 pandemic that uses the variables proposed in this study, the framework I used for the inclusion of the sociodemographic variables in this model was based on the studies of Perry et al. (2021) and Hernández Bringas (2021), developed in the context of COVID-19, and Crystal and Shea (1990), for the use of sociodemographic variables to study inequalities.

---

[2] There is no exact criterion on the symptoms that could be linked to COVID-19 infection at the time of data collection; the data is only collected based on the interviewee's criteria.

b) Employment type

It has been seen that, during the COVID-19 pandemic, risks of infection were found according to the type of occupation, with the unemployed being the most affected (Mejia et al., 2020), skilled workers have suffered less from the crisis generated by COVID-19 (Nájera & Huffman, 2020).

This variable has the following categories: Low-skilled worker,[3]Administrative ,[4]Professional and technical,[5]Management.[6]The Classification of Occupations of Bolivia 2009 (COB—09) is the result of the International Standard Classification of Occupations (ISCO-08) developed by the International Labour Organization—ILO, to be able to make comparisons between countries (INE, 2010). For the purposes of the analysis, the occupations of managerial, administrative and professional and technical workers were grouped into a single category. Another category is kept for Low-skilled worker and, finally, for people who do not work. The reference category is people who do not work.

The limitations of this variable are observed in the grouping of some categories, instead of keeping them individually, although in the latter way, the cases would be very few.

c) Household living arrangements

Some studies show the effect of COVID-19 according to the residential arrangement, people 50 + living in unipersonal households, among other sociodemographic variables, are presented as a group highly vulnerable to COVID-19 (González-González et al., 2021; Welti-Chan & Ramírez-Penagos, 2021), as well as older persons living alone were more likely to report COVID-19 symptoms (Andrade et al., 2022), overcrowded conditions present a greater possibility of contagion (Oxfam, 2020), as does the greater exposure to violence and abuse that older persons sharing confinement with family members or caregivers may suffer (United Nations, 2020).

For all these reasons, the categories used for the analysis are the following: Living alone,[7]Couples with/without children,[8]extended[9] y Couples with/without relatives.[10]The last ones are grouped in a single category (Couples with/without relatives). The reference group is the individual household.

---

[3] Included are: 5) Service and Sales Workers, 6) Agricultural, Livestock, Farming, Forestry and Fishing Workers, 7) Construction, Manufacturing and Other Trades Workers, 8) Plant, Machinery and Assembly Operators, and 9) Unskilled Workers.

[4] Includes 4) Office Employees.

[5] Includes: 2) Scientific and Intellectual Professionals and 3) Middle Level Technicians.

[6] Includes 1) Executives of the Public Administration and Business.

[7] A single person, who by definition is classified as the head of household.

[8] The head of household and his or her spouse, with or without children.

[9] Composed of the nuclear household and other family members (son or daughter-in-law, brother or sister or brother-in-law, parents or parents-in-law or other relatives).

[10] Consisting of the nuclear or extended household plus other non-family members (other non-relatives).

The limitations of this variable are observed in the grouping of some categories, instead of keeping them individually, although in the latter way, the cases would be very few.

d) Attained education

Some studies show the effect of COVID-19 on education. an association was found between educational level and knowledge of COVID-19 symptoms (Irigoyen-Camacho et al., 2020), people over 50 years of age with less schooling are presented as a group highly vulnerable to COVID-19 and its repercussions (González-González et al., 2021), as well as non-communicable diseases, a higher educational level reverses the inequality of hypertension and diabetes (Eyzaguirre & Olivera, 2020). In general, the differentiated educational responses of the different countries in the region show challenges when implementing measures, which should focus on the most vulnerable population groups (indigenous peoples, Afro-descendants, refugees, migrants, socioeconomically disadvantaged populations, people with disabilities) (Kemet & Paul, 2021).

The following categories will be used as shown in Table 1:

The reference category to be used is college graduate.

The limitations of this variable are observed in the grouping of some categories, instead of keeping a continuous variable.

e) Age

There is an increase in the prevalence of cognitive impairment in older persons in Latin America, varying by country, with age, gender, and race is associated with this increased risk due to social and socio-health factors (Soto-Añari et al., 2021). In addition, greater marginalization of older persons is observed given the confinement and concentration of health resources in COVID-19, which can make it difficult to access health services for the treatment of pre-existing conditions, making them more vulnerable to COVID-19 (Lustig & Tommasi, 2020; United Nations, 2020).

As the COVID-19 pandemic progressed, some study results shows that older people adopted mitigating personal behavioural changes more than younger people (Kim & Crimmins, 2020), Also, in young males (18–39 years), the percentage of lung lesions was higher than other age groups (Goethals et al., 2020). "Imposing

Table 1 Bolivia: Educational categories according to years of study

Category	Years of education
Grade	0–6
Some high school	7–11
High school graduate	12
College graduate	13–22

Source: Based on Ministry of education (2010) Crystal et al. (1992)

strict homogeneous lockdown policies may not only adversely affect the most vulnerable but also increase pre-existing health inequalities related to precarious conditions of underserved territories" (Cortinez-O'Ryan et al., 2020, p. 2), considering decreases in physical activity among vulnerable populations as children and older adults, since the outbreak of COVID-19 (Goethals et al., 2020).

To have sufficient comparative information with the other cohorts, it is recommended that they were not younger than 30 years (Coubes et al., 2017), so the analysis will incorporate the three age groups: 30–44, 45–59, and 60+. Being the reference category, the 60+ age group.

f)   Ethnicity

In the United States, health inequalities disadvantageous to ethnic-racial populations (Latinos, African Americans, Asians, and other minorities) were observed with a higher incidence of COVID-19 in general mortality, compared to the white population (Canales & Castillo Fernández, 2020). A study shows inequalities in Mexican ethnic minorities going through higher education, which is accentuated by the pandemic (Pérez Mora, 2021). Likewise, in the State of Chiapas (Mexico) -mainly with an indigenous population in conditions of marginalization, poverty, and inequality- indigenous populations, due to their high levels of malnutrition, are highly vulnerable to the effects of COVID-19 (Medina & Arévalo, 2021), and the inequalities deepened by the pandemic have a greater impact on indigenous women and girls in rural areas (Dreon, 2021).

The experience of the HIV-AIDS epidemic showed that the promotion of prevention measures must be accompanied by an understanding of the sociocultural dimensions. In addition, in Latin American countries, social vulnerability, poverty, and marginalization due to ethnic status are reasons why not all people were able to follow health recommendations (Juárez-Ramírez et al., 2021).

In the construction of the ethnic variable, Molina et al., (2006) propose the Ethnic-Linguistic Condition index -CEL for its acronym in Spanish-, which incorporates two dimensions: self-identification and linguistic,[11] to measure in an ordinal way the location in which each person is located, having at one extreme the full ethnic condition (Aymara, Quechua, etc.), and at the other extreme, the null condition. This index is constructed from the following questions:

– Which languages do you speak?[12]
– Which language or languages did you learn to speak as a child?[13]
– Do you consider yourself to belong to any of the following native or indigenous peoples?[14]

[11] For children under 5 years of age, the ethnicity of the head of household is imputed.

[12] It does not include people who do not yet speak or who are unable to speak.

[13] It does not include those who do not yet speak and who cannot speak.

[14] As a Bolivian woman or man, to which nation, indigenous nation or Afro-Bolivian nation or community do you belong?

As a result of these questions, 8 possible combinations are observed, of which people with non-indigenous ethnic status will be considered those with null status and indigenous people those with linguistic status cut-off, membership cut-off, and full ethnic status (Table 2).

This variable is categorized as non-indigenous = 0 and Indigenous = 1. The reference group to be used is the non-indigenous category.

The limitations of this index consist in having information on its composing variables, namely: ethnic affiliation, spoken language and mother tongue.

g)   Control variables

Some demographic control variables are included gender (coded 1 for women and 0 for men); Current status (coded 0 for not working and 1 for working); and residence area (coded 1 for rural and 0 for urban).

Analytical Strategy

To determine inequalities in the conditions under which people self-reported COVID-19 symptoms (n = 16.910), in the context of the aging process and by ethnicity, I begin with a bivariate analysis. Subsequently, I perform logistic regressions to establish the risks of self-reported COVID-19 symptoms based on the work done by Goesling (2007).

To determine whether inequalities varied by ethnicity, I conducted the analysis separately for non-indigenous and indigenous people. To test whether the

Table 2 Bolivia: possible combinations by ethnolinguistic status (CEL) by indigenous/non-indigenous cohorts, 2020

Combination	Ethnic-Linguistic Status			Population	Ethnicity
	EA	SL	MT	2020	
0	No	No	No	6,346,215	Non-indigenous
1	No	Yes (c/c)	No	963,447	
2	No	Yes (c/c)	Yes	676,925	Indigenous
3	No	Yes (s/c)	Yes	111,276	
4	Yes	No	No	667,032	
5	Yes	Yes (c/c)	No	692,228	
6	Yes	Yes (c/c)	Yes	1,513,738	
7	Yes	Yes (s/c)	Yes	327,275	
Total				11,298,135	

Source: Author's elaboration based Molina et al. (2006) and Candia Calderón (2018), data from the Household Survey 2020, INE

Where:

EA Ethnic affiliation; *SL* Spoken language; *MT* Mother Tongue

Yes(c/c) = Yes with Spanish; Yes(S/c) = Yes without Spanish

coefficients by ethnicity are equal, I used the Chow test (Wang, 2020). I also ran an interacted model with ages to see the variation of the effect of the variables in the different age groups, but no statistical significance was found in the variables used.

Results

Figure 2 shows the descriptive analysis of the trends of people who reported COVID-19 symptoms, disaggregated by age (for more detail see Appendix Table 4). Regarding employment type, the 45–59 age group reports a higher percentage of people with COVID-19 symptoms than those aged 60+ with a lower percentage of people reporting COVID-19 symptoms. People aged 30–44 years report percentages that are between the other two age groups. Likewise, all three age groups reported higher percentages for management, administrative, and professional and technical occupations. People aged 60+ who do not work report slightly lower percentages than those aged 30–44.

Regarding household living arrangements, for the 45–59 and 60+ age groups, a positive trend is observed: the greater the number of people in the household, the higher the percentage of people with COVID-19 symptoms. In contrast to the 30–44 age group, this relationship is inverse. Also, the percentages of
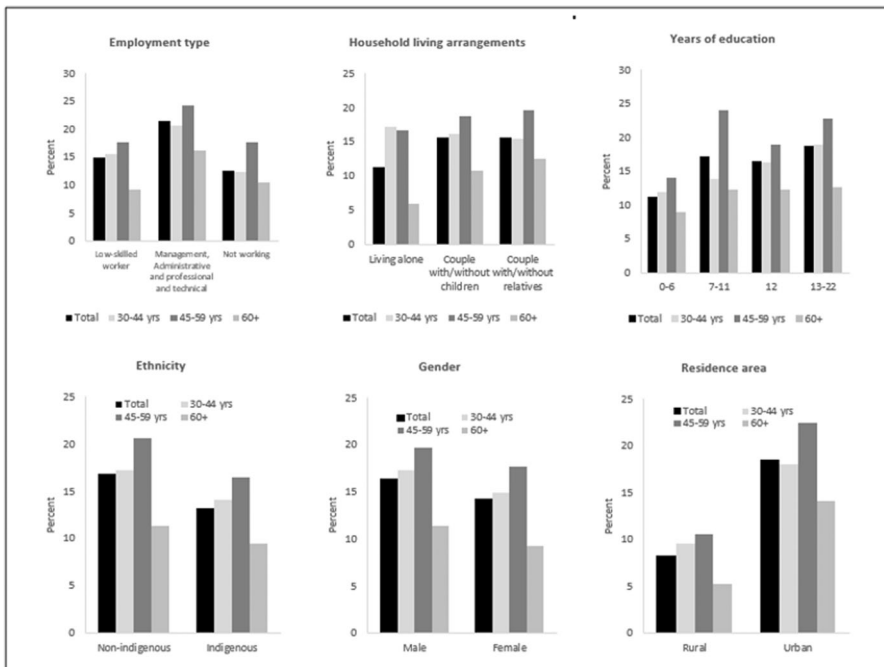

Fig. 2 Bolivia: Percent of people with COVID19 reported symptoms, total and by age, socio-demographic variables. Source: Based on INE Bolivia Households Survey, 2020

people aged 60 + are lower than the other age groups. The percentage of people aged 30–44 and 45–59 living alone is similar, higher than those aged 60 + . These results show behaviour contrary to those established in other studies, regarding the greater vulnerability of people living alone, although the behaviour is confirmed for people living in groups of three or more.

As for education, for the 30–44 and 45–59 age groups, a positive trend is observed as the number of years of education increases. For the 60 + group, those with 0–6 years of education report lower percentages than for the rest of the years of education, although the percentage is maintained for people with 7 and more years of education. These results are contrary to what some studies show regarding the inverse relationship between educational level and COVID-19 symptoms.

In addition, the differences in the number of people who reported COVID-19 symptoms according to ethnicity show a higher percentage in non-indigenous people. In both ethnic groups, people aged 45–59 years report higher percentages, followed by those aged 30–44 years. Finally, people aged 60 + report lower percentages, but this is higher for non-indigenous people. These results are contrary to what some studies show that indigenous people are more vulnerable.

On the other hand, as for differences by gender, higher percentages reporting COVID-19 symptoms were observed in men. In both groups, people aged 45–59 years report higher percentages, followed by those aged 30–44 and, finally, those aged 60 + . The gender behaviour is by the studies that refer to the greater vulnerability of men—although this behaviour, when analysed by age group, is contrary to what some studies show, placing older persons more vulnerable to the other age groups.

Finally, regarding the area of residence, people living in urban areas reported higher percentages of COVID-19 symptoms than those living in rural areas. In both areas of residence, a higher percentage was observed in people aged 45–59 years, followed by those aged 30–44 years, with people aged 60 + at the end.

In summary, the analysis of trends by age and sociodemographic variables shows that the group of people aged 45–59 years are those who report COVID-19 symptoms with the highest percentage, followed by the 30–44 group, and finally the 60 + group. The percentage of people aged 60 + who report COVID-19 symptoms, disaggregated by education, does not show much variation among those with 7 or more years, so the behaviour of this variable will be seen in the logistic regression models. On the other hand, people aged 30–44 years who live alone, and report COVID-19 symptoms have a higher percentage than the rest of household living arrangements, unlike the other two age groups, which show lower percentages in people living alone. Inequalities are also observed in terms of ethnic status, unfavourable for non-indigenous people; in terms of gender, unfavourable for men, and, finally, disadvantageous for people living in urban areas.

Figure 3 shows the descriptive analysis of the trends of people who self-reported COVID-19 symptoms, disaggregated by ethnic condition. In employment type, unfavourable percentages are observed for low-skilled workers, being higher in non-indigenous people. In management, administrative and professional
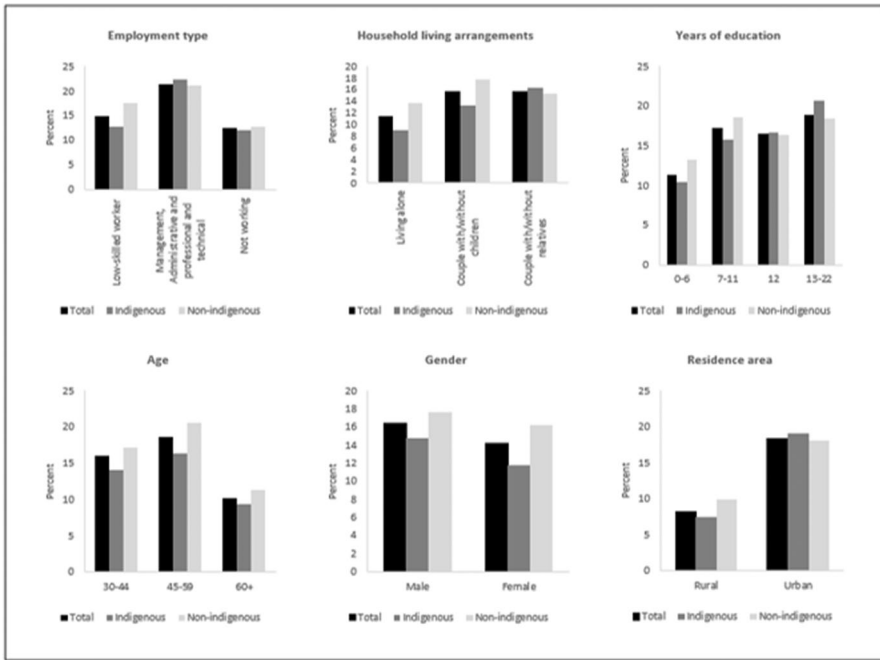
Fig. 3 Bolivia: Percent of people with COVID19 reported symptoms, total and by ethnicity, socio-demographic variables. Source: Based on INE Bolivia Households Survey, 2020

and technical, higher percentages are observed, but they are similar for both ethnic groups. The same is true for people who do not work, with lower percentages, but similar in both ethnic groups.

In turn, for people living alone and couples with/without children, in the case of non-indigenous persons, higher percentages are observed than for indigenous persons. Only in couples with/without relatives are there no differences by ethnic condition.

Regarding years of education, the percentage of people reporting COVID-19 symptoms with up to 11 years of education is higher in non-indigenous people, equal in people with 12 years of education, and higher in indigenous people with 13 + years of education.

Concerning age, the differences in people who reported COVID-19 symptoms according to ethnic condition show a higher percentage in non-indigenous people. In both ethnic groups, people aged 45–59 years report higher percentages, followed by those aged 30–44 years. Finally, people aged 60 + report lower percentages, but this is higher for non-indigenous people. These results are contrary to what some studies show that indigenous persons are more vulnerable.

In terms of gender, the highest percentages are in men of both ethnic conditions, being higher for non-indigenous men. Finally, the percentage of people residing in

urban areas is approximately double that of those living in rural areas, being higher for non-indigenous people.

In summary, the trend analysis shows, in general, higher percentages of people who reported COVID-19 symptoms in those of non-indigenous status, except in people with more years of education (13–22 years), where a higher percentage is reported in indigenous people. On the other hand, no difference is found in the percentages of people who perform management, administrative, and professional, and technical work, and those who do not work; and those who live in couples with/without relatives.

Table 3 reports the logistic regression results. Model 1 reports the result of the logistic regression, in which the age variable and the rest of the sociodemographic variables are included (Employment type, Household living arrangements, Years of education) and control variables (Gender, Current status, Residence area). The persons who lived alone were less likely than those living in a Couple with/without relatives' household arrangement to self-reported COVID-19 symptoms (OR = 0.79, 95% CI: 0.66–0.93, p < 0.01). The odds to self-reported COVID-19 symptoms of the older persons aged 45–59 (OR = 1.44, 95% CI: 1.28–1.63, p < 0.05) were relatively more likely (44%) than younger people (20%) (OR = 1.20, 95% CI: 1.06–1.35, p < 0.01). Also, the odds for those living in urban areas were more likely than those living in the rural area to self-reported COVID-19 symptoms (OR = 1.68, 95% CI: 1.50–1.89, p < 0.05). The Bayesian information criterion (BIC) = 15,237.77.

Model 2 reports the result of the logistic regression, in which the variable ethnic condition and the rest of the sociodemographic variables are included (Employment type, Household living arrangements, Years of education) and control variables (Gender, Current status, Residence area). The persons who worked in Management, Administrative and professional, and technical were more likely than those who were not working to self-reported COVID-19 symptoms (OR = 1.46, 95% CI: 1.08–1.97, p < 0.001). The odds of living alone were still 23% less than those living with a couple and with/without relatives (OR = 0.77, 95% CI: 0.65–0.91, p < 0.01). Persons with some high school (7–11 yrs.) were more likely than those with college or greater education to self-reported COVID-19 symptoms (OR = 1.16, 95% CI: 1.01–1.34, p < 0.001). The odds of male to self-reported COVID-19 symptoms are 10% greater than female (OR = 1.10, 95% CI: 1.02–1.20, p < 0.001). And those who were living in urban areas were more likely than those living in the rural area (OR = 1.68, 95% CI: 1.50–1.89, p < 0.05). The value of BIC = 15,262.73.

Model 3 reports the result of the logistic regression, in which the variables age and ethnicity are included, in addition to the rest of the sociodemographic variables (Employment type, Household living arrangements, Years of education) and control variables (Gender, Current status, Residence area).

The odds of persons who worked in Management, Administrative and professional, and technical were 36% more likely than those who were not working to self-reported COVID-19 symptoms (OR = 1.36, 95% CI: 1.01–1.84, p < 0.001). Those who were living alone were less likely (21%) than those living in a Couple with/without relatives' household arrangement to self-reported COVID-19 symptoms (OR = 0.79, 95% CI: 0.66–0.94, p < 0.01). The odds to self-reported

Table 3 Bolivia: Odds ratio for employment type and other factors reporting COVID-19 symptom, 2020

| | | | | Model (4) | | |
| | | | | Interacted model by ethnicity | | |
	Model 1	Model 2	Model 3	Non-indigenous		Indigenous
Variable						
Employment type (3:Not working)						
Low-skilled worker	1.12	1.21	1.13	1.12	Ɨ	1.27
	(0.163)	(0.176)	(0.165)	(0.230)		(0.352)
Management, Administrative and professional and technical	1.35	1.46*	1.36*	1.36	Ɨ	1.50
	(0.207)	(0.223)	(0.209)	(0.286)		(0.413)
Household living arrangements (3:Couple with/without relatives)						
Living alone	0.79**	0.77**	0.79**	0.87	Ɨ	0.68**
	(0.069)	(0.068)	(0.070)	(0.098)		(0.096)
Couple with/without children	0.91	0.93	0.92	1.03	Ɨ	0.75 **
	(0.051)	(0.052)	(0.052)	(0.073)		(0.069)
Years of education (4:13–22 yrs)						
Grade (0–6 yrs)	0.90	0.91	0.92	0.87	Ɨ	0.89
	(0.060)	(0.061)	(0.063)	(0.077)		(0.105)
Some high school (7–11)	1.12	1.16*	1.14	1.12	Ɨ	1.05
	(0.081)	(0.083)	(0.082)	(0.099)		(0.137)
High school graduate (12)	0.98	1.00	0.99	0.99	Ɨ	0.90
	(0.065)	(0.066)	(0.066)	(0.078)		(0.117)
Age (3:60+)						
30–44	1.20**		1.19**	1.11	Ɨ	1.26*
	(0.075)		(0.074)	(0.091)		(0.124)
45–59	1.44***		1.44***	1.32**	Ɨ	1.59***
	(0.090)		(0.090)	(0.111)		(0.149)
Etnicity (1:Non-indigenous)						
Indigenous		0.92	0.93			
		(0.042)	(0.043)			
Gender (2:Female)						
Male	1.12	1.10*	1.12**	1.03	Ɨ	1.27**
	(0.049)	(0.048)	(0.049)	(0.058)		(0.090)
Current status (2:Working)						
Not working	0.92	0.92	0.92	0.86	Ɨ	0.95
	(0.129)	(0.128)	(0.129)	(0.058)		(0.190)
Residence area (1:Rural)						
Urban	1.68***	1.68***	1.67***	0.96	Ɨ	0.40***
	(0.100)	(0.101)	(0.100)	(0.080)		(0.034)
Constant	0.11***	0.12***	0.11***	0.18***		0.18***
	(0.019)	(0.021)	(0.019)	(0.040)		(0.040)
Number of obs	16,910	16,910	16,910		16,910	
LR chi2(dfs)	276	241	279		353	

Table 3 (continued)

	Model 1	Model 2	Model 3	Model (4) Interacted model by ethnicity	
				Non-indigenous	Indigenous
Prob > chi2	0.000	0.000	0.000	0.000	
Pseudo R2	0.018	0.016	0.018	0.023	
BIC	15,238	15,263	15,245	15,288	

Reference categories are in parentheses next to the category

Standard errors in parentheses

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (two-tailed tests)

Ɨ Significant differences $p < 0.05$ (two-tailed tests)

Source: INE Households Survey, 2020

COVID-19 symptoms of the older persons aged 45–59 (OR = 1.44, 95% CI: 1.27–1.62, p < 0.05) were relatively more likely (44%) than younger people (OR = 1.19, 95% CI: 1.05–1.35, p < 0.01). The odds of male to self-reported COVID-19 symptoms are 12% greater than female (OR = 1.12, 95% CI: 1.03–1.23, p < 0.01). And the odds who were living in urban areas were 67% more likely than for those living in rural areas (OR = 1.67, 95% CI: 1.48–1.87, p < 0.05). The value of BIC = 15,244.98.

Model 4 reports the result of the logistic regression interacted by ethnicity. The odds for indigenous living alone to self-reported COVID-19 symptoms is 32% less likely than the non-indigenous living alone (OR = 0.68, 95% CI: 0.51–0.89, p < 0.01). The indigenous living in a couple with/without children household arrangement were less likely than those non-indigenous (OR = 0.75, 95% CI: 0.62–0.90, p < 0.01). The odds of indigenous people of age 30–44 were more likely (26%) than non-indigenous of the same age to self-reported COVID-19 symptoms (OR = 1.26, 95% CI: 1.04–1.53, p < 0.01). The odds of indigenous persons of age 45–59 were 59% (OR = 1.59, 95% CI: 1.32–1.91, p < 0.05) more likely than non-indigenous to self-reported COVID-19 symptoms (OR = 1.32, 95% CI: 1.12–1.55, p < 0.01). The odds for indigenous male were relatively more likely (27%) than non-indigenous male (OR = 1.27, 95% CI: 1.10–1.46, p < 0.01). The odds to self-reported COVID-19 symptoms for indigenous living in rural area (OR = 0.40, 95% CI: 0.34–0.47, p < 0.05) were less likely than those non-indigenous living in rural area. The value of BIC = 15,287.89.

Discussion

The proposed objectives of this article were to determine the association between sociodemographic variables (employment type, household living arrangements, years of education, age) with self-reported COVID-19 symptoms. And to investigate whether this

relationship shows inequalities by ethnicity and age. This study focuses on the Bolivian population, disaggregating into three age groups to analyse the effect of the pandemic on the aging process, and disaggregating by ethnicity to establish inequalities in response to COVID-19. The use of data from the Household Survey facilitates the analysis, although as this is the first time that some questions related to COVID-19 are included, their sensitivity to the context should be taken into account and, hopefully, more information will become available in the following years, to be able to carry out longitudinal studies.

The age trend analysis by sociodemographic variables shows that the group of people aged 45–59 years are those who report COVID-19 symptoms with the highest percentage, followed by the group of 30–44, and finally the 60 + people, consistent with the findings of Paz (2020). The percentage of people aged 60 + who report COVID-19 symptoms, disaggregated by education, does not show much variation among those with 7 or more years, so the behaviour of this variable will be seen in the logistic regression models. On the other hand, people aged 30–44 years who live alone, and report COVID-19 symptoms have a higher percentage than the rest of household living arrangements, unlike the other two age groups, which show lower percentages in people living alone. Inequalities are also observed in terms of ethnic status, unfavourable for non-indigenous people; in terms of gender, disadvantageous for men, and, finally, unfavourable for people living in urban areas.

The analysis of the trends by ethnicity shows, in general, higher percentages of people who reported COVID-19 symptoms in those of non-indigenous status, except in people with more years of education (13–22 years), where a higher percentage is reported in indigenous people. On the other hand, no difference is found in the percentages of people who perform management, administrative, and professional, and technical work, and those who do not work; and those who live in couples with/without relatives.

The results of the regressions show that when the age-group variable is included the persons living alone were less likely than those living in a Couple with/without relatives' household arrangement to self-reported COVID-19 symptoms contrasting with the findings of González-González et al.(2021) and Welti-Chan and Ramírez-Penagos (2021); The odds of the older persons aged 45–59 were relatively more likely than younger people, consistent with the findings of Paz (2020). Also, the odds for those living in urban areas were more likely than those living in rural areas to self-reported COVID-19 symptoms.

Including the ethnicity variable shows that persons who worked as Management, Administrative and professional, and technical were more likely than those who were not working to self-reported COVID-19 symptoms. The odds of living alone were less than those living with a couple and with/without relatives. Persons with some high school (7–11 yrs.) were more likely than those with college or greater education to self-reported COVID-19 symptoms. The odds of male self-reported COVID-19 symptoms are greater than female. And those who were living in urban areas were more likely than those living in rural areas.

Including the variable of ethnicity and age group show that persons who worked in Management, Administrative and professional, and technical were more likely than those who were not working to self-reported COVID-19 symptoms, contrasting with the findings of Nájera and Huffman (2020), possibly this is due to the high flexibility in complying with sanitary measures, as well as to the social situation they

were going through. Those who were living alone were less likely than those living in a Couple with/without relatives' household arrangement, consistent with the findings of Oxfam (2020), which can be explained by the lack of contact with other people, as opposed to those residential arrangements in which they live with more people, susceptible to contagion. The odds of the older persons aged 45–59 were relatively more likely than younger people, consistent with the findings of Paz (2020), which can be explained is because this age group had to carry out activities outside the home, such as buying food or for activities related to the political and social situation, temporarily put aside the quarantine, going to places with more people, so the risk of contagion increased. The odds of male self-reported COVID-19 symptoms are greater than female. And the odds who were living in urban areas were more likely than for those living in rural areas.

The analysis of the interacted models by ethnicity shows that the odds for indigenous living alone to self-reported COVID-19 symptoms are less likely than the non-indigenous living alone. As well the indigenous living in a couple with/without children household arrangement were less likely than those non-indigenous. The odds of indigenous people of age 30–44 were more likely than non-indigenous of the same age, and the odds of indigenous persons of age 45–59 were more likely than non-indigenous to self-reported COVID-19 symptoms. The odds for indigenous male were relatively more likely than for non-indigenous males. The odds of self-reported COVID-19 symptoms for indigenous living in rural areas were less likely than those non-indigenous living in the rural area.

These results show inequalities in the self-reported COVID-19 symptoms, being higher for persons aged 45–59 years, followed by those aged 30–44 years, and lower for persons aged 60+, which is somehow contrary to some findings that place older persons with higher vulnerability (Eyzaguirre & Olivera, 2020) and in agreement with Taboada et al (2021). This may show, in some way, the inequalities of access for people 60+, who due to quarantine measures could not/would not register when they presented self-reported COVID-19 symptoms.

Likewise, non-indigenous people show higher risks of self-reported COVID-19 symptoms, a situation that is contrary to the findings of Mesa Vieira et al. (2020), in which they establish that, due to differences in the immune profile, the response to a new virus, such as SARS-CoV-2, can be unexpected and even deadly in minority populations. Also, this could be explained by the inequalities in access to health services by indigenous people, generating an underreporting of this population, and/or by cultural and informational factors that did not report self-reported COVID-19 symptoms.

Conclusions

This study is the first to use information from the 2020 Household Survey in Bolivia, referring to the behaviour of COVID-19. In this regard, there are interesting findings, although they must be interpreted considering the entire political and social context in which the survey was conducted. As established in the section on the independent variable, the information from the self-reporting of symptoms by COVID-19 could be overrepresented for the non-indigenous population and/or underrepresented for indigenous people, so it is recommended that the results presented in this study should be interpreted taking this aspect into consideration. It could be interesting to reinforce/refute these results with information from new, updated, and higher quality household surveys.

Younger people (45–59 age group) show higher risk factors to self-report COVID symptoms than older adults (60+), which show lower risks. These are increased in people working in managerial, administrative and professional, and technical positions, those living in a household with/without relatives, men, those living in urban areas, and/or non-indigenous people.

As established in the objectives, this study suggests that the effects of COVID-19, although it affects the elderly, it is important to consider that people under 60 years of age show a higher risk of infection, establishing a contribution for studies on aging, understood as a process, and on the other hand, indigenous people show a lower probability of infection by COVID-19, unlike those studies that establish them as a more vulnerable population, as established by Flores-Ramírez et al. (2021).

Limitations

This is the first large-scale survey to include questions related to COVID-19 in Bolivia, and the data collection was conducted in the decline of the first wave of the pandemic, but also coming out of a delicate social process in which important political events took place, which are detailed in the Bolivia section.

In addition, it should be considered that there could be an over-registration in the data of the self-reporting of persons by COVID-19 and under-registration in the data of persons confirmed by COVID-19 by laboratory, also due to the social problems that accompanied the pandemic.

Appendix

Table 4 Descriptive Statistics. Persons by COVID-19 symptom status

Variable	Total		Indigenous		Non-indigenus		30–44 yrs		45–59 yrs		60+	
	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With
Total	**84.8**	**15.2**	**86.8**	**13.2**	**83.1**	**16.9**	**83.9**	**16.1**	**81.3**	**18.7**	**89.7**	**10.3**
Employment type												
Low-skilled worker	85.1	14.9	87.3	12.7	82.4	17.6	84.3	15.7	82.4	17.6	90.7	9.3
Management, Administrative and professional and technical	78.6	21.4	77.6	22.4	78.8	21.2	79.3	20.7	75.7	24.4	83.7	16.3
Not working	87.4	12.7	87.8	12.2	87.1	12.9	87.5	12.5	82.3	17.7	89.4	10.6
Household living arrangements												
Living alone	88.6	11.4	90.9	9.1	86.3	13.7	82.8	17.2	83.3	16.7	93.9	6.1
Couple with/without children	84.3	15.7	86.7	13.3	82.2	17.8	83.9	16.1	81.3	18.7	89.1	10.9
Couple with/without relatives	84.3	15.8	83.7	16.3	84.6	15.4	84.6	15.4	80.4	19.6	87.4	12.6
Years of education												
Grade (0–6 yrs)	88.7	11.3	89.5	10.5	86.8	13.2	88.0	12.0	85.9	14.1	91.0	9.0
Some high school (7–11)	82.7	17.3	84.3	15.7	81.5	18.6	86.1	13.9	75.9	24.1	87.7	12.3
High school graduate (12)	83.5	16.5	83.3	16.7	83.6	16.4	83.7	16.3	81.0	19.1	87.7	12.3
College graduate (13–22)	81.1	18.9	79.3	20.7	81.6	18.5	81.0	19.1	77.3	22.8	87.3	12.7
Age												
30–44	83.9	16.1	85.9	14.1	82.8	17.2						
45–59	81.3	18.7	83.6	16.5	79.3	20.7						
60+	89.7	10.3	90.6	9.4	88.6	11.4						

Table 4 (continued)

	Total		Indigenous		Non-indigenus		30–44 yrs		45–59 yrs		60+	
	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With
Etnicity												
Non-indigenous	83.1	16.9					82.8	17.2	79.3	20.7	88.6	11.4
Indigenous	86.8	13.2					85.9	14.1	83.6	16.5	90.6	9.4
Control variables												
Gender												
Male	83.6	16.4	85.3	14.8	82.3	17.7	82.7	17.3	80.3	19.7	88.6	11.4
Female	85.8	14.2	88.2	11.8	83.8	16.2	85.0	15.0	82.2	17.8	90.8	9.2
Current status												
Not working	87.2	12.8	87.6	12.4	87.0	13.0	87.4	12.6	82.0	18.0	89.5	10.5
Working	83.7	16.3	86.5	13.5	81.2	18.8	82.9	17.1	81.1	18.9	90.0	10.0
Residence area												
Rural	91.8	8.2	92.5	7.5	90.0	10.0	90.4	9.6	89.4	10.7	94.8	5.2
Urban	81.6	18.4	80.9	19.1	81.9	18.1	82.0	18.0	77.6	22.4	85.9	14.2

Source: INE Households Survey, 2020

Persons by COVID-19 symptom status ($n_{total} = 16\,910$; $n_{indigenous} = 7\,275$; $n_{non\text{-}indigenous} = 9\,635$)

Declarations

Ethics Approval Not applicable.

Conflicts of interest/Competing interests The author has no relevant financial or non-financial interests to disclose.

References

Andrade, F. C. D., Quashie, N. T., & Schwartzman, L. F. (2022). Coresidence increases the risk of testing positive for COVID-19 among older Brazilians. *BMC Geriatrics, 22*(1), 1–16. https://doi.org/10.1186/s12877-022-02800-6

Aslan, G., & Kant, E. (2022). Relationship between social exclusion and anxiety in older people during the COVID-19 pandemic. *Geriatrics & Gerontology International, 22*(3), 240–245. https://doi.org/10.1111/ggi.14335

Avila, R., & Guerena, A. (2020). *Evitar el Etnocidio: Pueblos indígenas y derechos territoriales en crisis frente a la COVID-19 en América Latina.* https://doi.org/10.21201/2020.6294

Babulal, G. M., Torres, V. L., Acosta, D., Agüero, C., Aguilar-Navarro, S., Amariglio, R., Ussui, J. A., Baena, A., Bocanegra, Y., Brucki, S. M. D., Bustin, J., Cabrera, D. M., Custodio, N., Diaz, M. M., Peñailillo, L. D., Franco, I., Gatchel, J. R., Garza-Naveda, A. P., González Lara, M., … Quiroz, Y. T. (2021). The impact of COVID-19 on the well-being and cognition of older adults living in the United States and Latin America. *EClinicalMedicine*, *35*, 100848. https://doi.org/10.1016/j.eclinm.2021.100848

Bastiani, L., Fortunato, L., Pieroni, S., Bianchi, F., Adorni, F., Prinelli, F., Giacomelli, A., Pagani, G., Maggi, S., Trevisan, C., Noale, M., Jesuthasan, N., Sojic, A., Pettenati, C., Andreoni, M., Antonelli Incalzi, R., Galli, M., & Molinaro, S. (2021). Rapid COVID-19 Screening Based on Self-Reported Symptoms: Psychometric Assessment and Validation of the EPICOVID19 Short Diagnostic Scale. *Journal of Medical Internet Research, 23*(1), e23897. https://doi.org/10.2196/23897

Bejaković, P., Škare, M., & Pržiklas Družeta, R. (2021). Social exclusion and health inequalities in the time of COVID-19. *Technological and Economic Development of Economy, 27*(6), 1563–1581. https://doi.org/10.3846/tede.2021.16001

Berger, P. L., & Luckmann, T. (1968). *La construcción social de la realidad.* https://doi.org/10.1007/BF00219282

Birbuet, J. C., & López, R. (2020). *Dinámica de expansión del COVID-19 en Bolivia durante las primeras 6 semanas.* RefSourcehttps://rafalopezv.io/static/covid/covid_19_bolivia.pdf%0Ahttp://bit.ly/pdf_covid_bol

Bull, B., & Robles Rivera, F. (2020). El COVID-19, las élites y el futuro de la economía política de la reducción de la desigualdad en América Latina. *Revista de La CEPAL, 132*(2), 79–94. https://doi.org/10.18356/16820908-2020-132-5

Busso, M., Camacho, J., Messina, J., & Montenegro, G. (2020). The Challenge of Protecting Informal Households during the COVID-19 Pandemic: Evidence from Latin America. *Inter-American Development Bank*, *June*. https://publications.iadb.org/en/the-challenge-of-protecting-informal-households-during-the-covid-19-pandemic-evidence-from-latin-america

Campechano-Escalona, E., & Cuasialpud Canchala, R. (2021). *Una mirada latinoamericana a la pandemia de COVID-19: Reflexiones desde las ciencias sociales y las humanidades* (E. Campechano-Escalona & R. Cuasialpud Canchala, Eds.; 1st ed.). Fondo Editorial Universidad César Vallejo. https://doi.org/10.18050/mirada.latina.covid

Canales, A. I. (2021). La desigualdad social frente al COVID-19 en el Área Metropolitana de Santiago (Chile). *Notas de Población, 47*(111), 13–41. https://doi.org/10.18356/16810333-47-111-2

Canales, A. I., & Castillo Fernández, D. (2020). Desigualdad social y étnico-racial frente a la covid-19 en Estados Unidos. *Migración y Desarrollo, 18*(35), 129–145. https://doi.org/10.35533/myd.1835.ac.dcf

Candia Calderón, G. A. (2018). *¿Bolivia cambia? Un análisis del "trabajo digno" y de las trayectorias laborales de la juventud boliviana, en el periodo 2007 – 2015* [Maestría, FLACSO México]. https://flacso.repositorioinstitucional.mx/jspui/handle/1026/194

Castañeda Gullot, C., & Ramos Serpa, G. (2020). Principales pandemias en la historia de la humanidad. *Revista Cubana de Pediatría*, *92*(1), 1–24. http://ref.scielo.org/8vnt6w

CELADE. (2020). *Vulnerabilidades sociodemográficas de las personas mayores frente al Covid-19*. https://www.cepal.org/es/enfoques/vulnerabilidades-sociodemograficas-personas-mayores-frente-al-covid-19

Chumacero, R. A. (2019). El camaleón, el mutante y Houdini: Resultados de las elecciones en Bolivia. In *Manuscript* (Vol. 17). http://rchumace.econ.uchile.cl/papers/

Cortinez-O'Ryan, A., Moran, M. R., Rios, A. P., Anza-Ramirez, C., & Slovic, A. D. (2020). Could severe mobility and park use restrictions during the COVID-19 pandemic aggravate health inequalities? Insights and challenges from Latin America. *Cadernos De Saúde Pública, 36*(9), 1–5. https://doi.org/10.1590/0102-311x00185820

Coubes, M.-L., Solis, P., & Cosio-Zavala, M. E. (2017). *Generaciones, cursos de vida y desigualdad social en México* (Vol. 1). EL COLEGIO DE MEXICO Y EL COLEGIO DE LA FRONTERA NORTE.

Crystal, S., & Shea, D. (1990). Cumulative Advantage, Cumulative Disadvantage, and Inequality Among Elderly People. *The Gerontologist, 30*(4), 437–443. https://doi.org/10.1093/geront/30.4.437

Crystal, S., Shea, D., & Krishnaswami, S. (1992). Educational Attainment, Occupational History, and Stratification: Determinants of Later-life Economic Outcomes. *Journal of Gerontology, 47*(5), S213–S221. https://doi.org/10.1093/geronj/47.5.S213

D'cruz, M., & Banerjee, D. (2020). 'An invisible human rights crisis': The marginalization of older adults during the COVID-19 pandemic – An advocacy review. *Psychiatry Research, 292*, 113369. https://doi.org/10.1016/j.psychres.2020.113369

Dreon, E. (2021). Modos de re-existencia de las mujeres indígenas y campesinas en Bolivia en tiempos de COVID-19. *Latinoamérica, Una Región En Crisis. Los Efectos de La Pandemia*, *25*, 85–107. https://www.iri.edu.ar/wp-content/uploads/2021/04/doctrab25alatina.pdf

ECLAC. (2020). *Follow-up of the evolution of COVID-19 Measures*. COVID-19 Observatory in Latin America and the Caribbean. https://www.cepal.org/en/subtopics/covid-19

ECLAC, & FILAC. (2020). Los pueblos indígenas de América Latina – Abya Yala y la Agenda 2030 para el Desarrollo Sostenible: Tensiones y desafíos desde una perspectiva territorial. In *Documentos de proyectos (LC/TS.2020/47)* (1st ed.). Naciones Unidas. https://repositorio.cepal.org/bitstream/handle/11362/45664/51/S2000125_es.pdf

Eyzaguirre, S. A. R., & Olivera, P. C. (2020). Desigualdad Espacial en Salud: Enfermedades No Transmisibles en Bolivia, Situación Actual y Perspectivas a Nivel Municipal. *SDSN Bolivia*, 1–17. https://www.sdsnbolivia.org/wp-content/uploads/2020/09/06-Estudio-Transversal-Desigualdad-espacial-en-salud-Enfermedades-no-transmisibles-en-Bolivia.pdf

Fantin, R., Brenes-Camacho, G., & Barboza-Solís, C. (2021). Defunciones por COVID-19: distribución por edad y universalidad de la cobertura médica en 22 países. *Revista Panamericana de Salud Pública, 45*, 1. https://doi.org/10.26633/RPSP.2021.42

Flores-Ramírez, R., Berumen-Rodríguez, A. A., Martínez-Castillo, M. A., Alcántara-Quintana, L. E., Díaz-Barriga, F., & Díaz de León-Martínez, L. (2021). A review of Environmental risks and vulnerability factors of indigenous populations from Latin America and the Caribbean in the face of the COVID-19. *Global Public Health, 16*(7), 975–999. https://doi.org/10.1080/17441692.2021.1923777

Garcia, P. J., Alarcón, A., Bayer, A., Buss, P., Guerra, G., Ribeiro, H., Rojas, K., Saenz, R., Salgado de Snyder, N., Solimano, G., Torres, R., Tobar, S., Tuesca, R., Vargas, G., & Atun, R. (2020). COVID-19 Response in Latin America. *The American Journal of Tropical Medicine and Hygiene, 103*(5), 1765–1772. https://doi.org/10.4269/ajtmh.20-0765

Goesling, B. (2007). The Rising Significance of Education for Health? *Social Forces, 85*(4), 1621–1644. https://doi.org/10.1353/sof.2007.0068

Goethals, L., Barth, N., Guyot, J., Hupin, D., Celarier, T., & Bongue, B. (2020). Impact of Home Quarantine on Physical Activity Among Older Adults Living at Home During the COVID-19 Pandemic: Qualitative Interview Study. *JMIR Aging, 3*(1), e19007. https://doi.org/10.2196/19007

González-González, C., Orozco-Rocha, K., Samper-Ternent, R., & Wong, R. (2021). Adultos mayores en riesgo de Covid-19 y sus vulnerabilidades socioeconómicas y familiares: un análisis con el ENASEM. *Papeles de Poblacion, 27*(107), 141–165. https://doi.org/10.22185/24487147.2021.107.06

Grusky, D. B. (2018). *Social stratification: Class, race, and gender in sociological perspective* (4th ed.). Routledge.

Grusky, D. B., & Weisshaar, K. R. (2014). The Questions We Ask About Inequality. In D. B. Grusky (Ed.), *Social Stratification: Class, Race, and Gender in Sociological Perspective (4th. Ed)* (pp. 1–16).

Hernández Bringas, H. (2021, July). COVID-19 en México: un perfil sociodemográfico. *Notas de Población N° 111*, 105–132. https://www.cepal.org/es/publicaciones/46557-covid-19-mexico-un-perfil-sociodemografico. Accessed 1 Jul 2022.

Hummel, C., Knaul, F. M., Touchton, M., Guachalla, V. X. V., Nelson-Nuñez, J., & Boulding, C. (2021). Poverty, precarious work, and the COVID-19 pandemic: Lessons from Bolivia. *The Lancet Global Health, 9*(5), e579–e581. https://doi.org/10.1016/S2214-109X(21)00001-2

Hummel, C., Velasco Guachalla, V. X., Nelson-Nuñez, J., & Boulding, C. (2020). Bolivia : lecciones sobre los primeros seis meses de la pandemia SARS-CoV-2. *Temas Sociales*, *47*(2), 98–129. http://www.scielo.org.bo/pdf/rts/n47/n47_a05.pdf

INE. (2010). *Clasificación de Ocupaciones de Bolivia COB - 2009*. http://anda.ine.gob.bo/index.php/catalog/54/download/549

Irigoyen-Camacho, M. E., Velazquez-Alva, M. C., Zepeda-Zepeda, M. A., Cabrer-Rosales, M. F., Lazarevich, I., & Castaño-Seiquer, A. (2020). Effect of Income Level and Perception of Susceptibility and Severity of COVID-19 on Stay-at-Home Preventive Behavior in a Group of Older Adults in Mexico City. *International Journal of Environmental Research and Public Health, 17*(20), 7418. https://doi.org/10.3390/ijerph17207418

Johns Hopkins University. (2022). *Global map*. Coronavirus Resource Center. https://coronavirus.jhu.edu/map.html. Accessed 5 Mar 2022.

Juárez-Ramírez, C., Théodore, F. L., & Gómez-Dantés, H. (2021). La vulnerabilidad y el riesgo: Reflexiones a propósito de la pandemia del covid-19. *Revista Da Escola De Enfermagem Da USP, 55*, 1–9. https://doi.org/10.1590/s1980-220x2020045203777

Kemet, S., & Paul, D. W. (2021). La educación en tiempos de la pandemia de COVID-19. In *Academic Medicine*. https://doi.org/10.1097/ACM.0000000000004003

Kim, J. K., & Crimmins, E. M. (2020). How does age affect personal and social reactions to COVID-19: Results from the national Understanding America Study. *PLoS ONE, 15*(11), e0241950. https://doi.org/10.1371/journal.pone.0241950

Koehlmoos, T. P., Janvrin, M. L., Korona-Bailey, J., Madsen, C., & Sturdivant, R. (2020). COVID-19 Self-Reported Symptom Tracking Programs in the United States: Framework Synthesis. *Journal of Medical Internet Research, 22*(10), e23297. https://doi.org/10.2196/23297

Leary, M. R. (1990). Responses to Social Exclusion: Social Anxiety, Jealousy, Loneliness, Depression, and Low Self-Esteem. *Journal of Social and Clinical Psychology, 9*(2), 221–229. https://doi.org/10.1521/jscp.1990.9.2.221

Lustig, N., & Tommasi, M. (2020). COVID-19 and the social protection of poor and vulnerable groups in Latin America: A conceptual framework. *Cepal Review, 2020*(132), 283–295.

Martínez, J., & Sánchez - Ancochea, D. (2020). Pactos sociales al servicio del bienestar en América Latina y el caribe. In *Documentos de Proyectos (LC/TS.2020/169)* (LC/TS.2020/169; Documentos de Proyectos). https://repositorio.cepal.org/handle/11362/46527?locale-attribute=es

Medina, G. N., & Arévalo, J. L. (2021). Pobreza, desigualdad, poblaciones indígenas y covid-19 en chiapas. In G. N. Medina & H. M. J. Acevedo (Eds.), *El sistema de salud de Chiapas ante la pandemia de la COVID-19* (1st ed., pp. 149–184). https://www.researchgate.net/profile/Cesar-Marcial-2/publication/346427978_OFERTA_DE_SERVICIOS_DE_SALUD_EN_EL_ESTADO_DE_CHIAPAS/

links/60482b9392851c077f2b1212/OFERTA-DE-SERVICIOS-DE-SALUD-EN-EL-ESTADO-DE-CHIAPAS.pdf#page=149

Mejia, C., Reyes-Tejada, A., Gonzales-Huaman, K., Leon-Nina, E., Murga-Cabrera, A., Carrasco-Altamirano, J., & Quispe-Cencia, E. (2020). Riesgo de estrés post traumático según ocupación y otros factores durante la pandemia por COVID-19 en el Perú. *Revista de La Asociación Española de Especialistas En Medicina Del Trabajo*, *29*(4), 265–273. https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1132-62552020000400265

Menni, C., Valdes, A. M., Freidin, M. B., Sudre, C. H., Nguyen, L. H., Drew, D. A., Ganesh, S., Varsavsky, T., Cardoso, M. J., El-Sayed Moustafa, J. S., Visconti, A., Hysi, P., Bowyer, R. C. E., Mangino, M., Falchi, M., Wolf, J., Ourselin, S., Chan, A. T., Steves, C. J., & Spector, T. D. (2020). Real-time tracking of self-reported symptoms to predict potential COVID-19. *Nature Medicine, 26*(7), 1037–1040. https://doi.org/10.1038/s41591-020-0916-2

Mesa Vieira, C., Franco, O. H., Gómez Restrepo, C., & Abel, T. (2020). COVID-19: The forgotten priorities of the pandemic. *Maturitas, 136*, 38–41. https://doi.org/10.1016/j.maturitas.2020.04.004

Ministry of education. (2010). *Ley de la educación No. 070"Avelino Siñani - Elizardo Pérez"*. Asamble Legislativa Plurinacional. https://www.minedu.gob.bo/index.php?option=com_content&view=article&id=3554&Itemid=470

Ministerio de Salud y Deportes. (2020). *COVID-19: Bolivia denuncia ante la OEA que bloqueo de carreteras causó más de 30 fallecidos por la falta de oxígeno*. Prensa. https://www.minsalud.gob.bo/4488-covid-19-bolivia-denuncia-ante-la-oea-que-bloqueo-de-carreteras-causo-mas-de-30-fallecidos-por-la-falta-de-oxigeno. Accessed 22 Feb 2022.

Molina B., R., Albó, X., & Figueroa, M. (2006). El índice combinado de condición étnica-lingüística (CEL) y su aplicación al Censo 2001 de Bolivia. In *Pueblos indígenas y afrodescendientes de América Latina y el Caribe: información sociodemográfica para políticas y programas* (pp. 455–470). https://doi.org/10.1080/02697459208722860

Molina, F. (2019). Bolivia:¿ golpe o (contra) revolución? *Nueva Sociedad*, 1–10. https://www.nuso.org/articulo/bolivia-golpe-o-contrarevolucion/?fbclid=IwAR0dIgxoErXdbi2oKUw8JGkYxTFfRlKZaJFGm9DlTN7b0zJ3VwNGXPWYli0

Nájera, H., & Huffman, C. (2020). *La pandemia y la pobreza en México en 2020* (Documento Divulgación). http://pued.unam.mx/export/sites/default/archivos/covid/ComunicadoPobrezaCOVID2021_Final.pdf

OEA. (2020). *La CIDH alerta sobre la especial vulnerabilidad de los pueblos indígenas frente a la pandemia de COVID-19 y llama a los Estados a tomar medidas específicas y acordes con su cultura y respeto a sus territorios*. Comunicado de Prensa. https://www.oas.org/es/cidh/prensa/comunicados/2020/103.asp. Accessed 1 Mar 2022.

Oliver, N., Barber, X., Roomp, K., & Roomp, K. (2020). Assessing the Impact of the COVID-19 Pandemic in Spain: Large-Scale, Online, Self-Reported Population Survey. *Journal of Medical Internet Research, 22*(9), e21319. https://doi.org/10.2196/21319

OMS. (2020). Actualización de la estrategia frente a la COVID-19. *Organización Mundial de La Salud*, 1–17. https://www.who.int/docs/default-source/coronaviruse/covid-strategy-update-14april2020_es.pdf?sfvrsn=86c0929d_10

OPS. (2015). *Garantizar que los pueblos indígenas tengan acceso a los servicios de salud todavía es una tarea pendiente en las Américas*. Noticias. https://www3.paho.org/hq/index.php?option=com_content&view=article&id=11132:ensuring-indigenous-populations-access-health-services-still-pending-task-americas&Itemid=135&lang=es. Accessed 2 Mar 2022.

Oxfam. (2020). El Coronavirus no discrimina, las desigualdades sí. *Nota Informativa De Oxfam, 20*, 1–13. https://socialprotection.org/discover/publications/el-coronavirus-no-discrimina-las-desigualdades-sí-vencer-la-pandemia-requiere

Paz, J. (2020). Older people in Argentina: Various disadvantages in the face of the coronavirus pandemic. *United Nations Development Programme*, 1–12. https://www.aacademica.org/jorge.paz/122%0A

Pérez Mora, R. (2021). Minorías étnicas, desigualdad y educación en tiempos de pandemia. *Dialogia, 38*, 1–23. https://doi.org/10.5585/38.2021.20441

Perry, B. L., Aronson, B., & Pescosolido, B. A. (2021). Pandemic precarity: COVID-19 is exposing and exacerbating inequalities in the American heartland. *Proceedings of the National Academy of Sciences, 118*(8). https://doi.org/10.1073/pnas.2020685118

Pieper, O. (2020). Bolivia: COVID-19, manifestaciones y caos político. *DW Actualidad*. https://p.dw.com/p/3fNnb. Accessed 17 Feb 2022.

Quer, G., Radin, J. M., Gadaleta, M., Baca-Motes, K., Ariniello, L., Ramos, E., Kheterpal, V., Topol, E. J., & Steinhubl, S. R. (2021). Wearable sensor data and self-reported symptoms for COVID-19 detection. *Nature Medicine, 27*(1), 73–77. https://doi.org/10.1038/s41591-020-1123-x

Rainer Echeverría, R., & Harumi Sueyoshi, J. (2020). Situación epidemiológica del COVID-19 en Sudamérica. *Revista de La Facultad de Medicina Humana, 20*(3), 521–523. https://doi.org/10.25176/RFMH.v20i3.2945

Reyes Dorado Gutiérrez, L. M. (2022). Índice de protección del entorno de hogares en Bolivia ante el COVID-19 según las recomendaciones de la OMS. *Revista Investigación & Desarrollo, 21*(2), 31–43. https://doi.org/10.23881/idupbo.021.2-3e

Reyes García, G. J. (2020). Covid-19 y recintos peniteciarios en Bolivia. *Temas Sociales*, *47*(2), 164–206. https://orcid.org/0000-0001-9414-4256.

Salazar, H., & Rocha, M. (2020). *Bolivia frente a la Covid-19. Entre la precariedad en salud y la gestión improvisada*. https://rosalux.org.ec/pdfs/BoliviaFrentealaCOVID19.pdf. Accessed 27 June 2022.

Sarker, A., Lakamana, S., Hogg-Bremer, W., Xie, A., Al-Garadi, M. A., & Yang, Y.-C. (2020). Self-reported COVID-19 symptoms on Twitter: An analysis and a research resource. *Journal of the American Medical Informatics Association, 27*(8), 1310–1315. https://doi.org/10.1093/jamia/ocaa116

Soto-Añari, M., Camargo, L., Ramos-Henderson, M., Rivera-Fernández, C., Denegri-Solís, L., Calle, U., Mori, N., Ocampo-Barbá, N., López, F., Porto, M., Caldichoury-Obando, N., Saldías, C., Gargiulo, P., Castellanos, C., Shelach-Bellido, S., & López, N. (2021). Prevalence of Dementia and Associated Factors among Older Adults in Latin America during the COVID-19 Pandemic. *Dementia and Geriatric Cognitive Disorders Extra, 11*(3), 213–221. https://doi.org/10.1159/000518922

Stefanoni, P. (2019). ¿ Qué pasa en Bolivia. *Nueva Sociedad*, 1–8. https://www.nuso.org/articulo/Bolivia-Evo-Morales-Carlos-Mesa-elecciones/?fbclid=IwAR38QPu_0aOxddjlZbqAahtrAn-SwW9ndmxV4bpOqEBbTOZk9HiTcBZpprM. Accessed 21 Feb 2022.

Taboada, S. C., Cascales, E. P., & Viveros, M. A. P. (2021). Comorbilidades más frecuentes asociadas al covid-19 en pacientes del laboratorio bioscience srl., Santa Cruz, Bolivia. *Revista de La ANCB-SC*, *2*(2), 71–77. https://www.upsa.edu.bo/es/publicaciones

Therborn, G. (2016). *Los campos de exterminio de la desigualdad*. Fondo de Cultura Económica.

Tito, C., Arias, A. M., Wanderley, F., & Losantos, M. (2020). Reflexiones sobre la Pandemia en Bolivia. *Serie Reflexiones Sobre La Pandemia En Bolivia*, *4*, 1–3. http://repositorio.ucb.edu.bo/xmlui/handle/20.500.12771/259

United Nations. (2020). *Informe de políticas: Los efectos de la COVID-19 en las personas de edad*. https://www.un.org/sites/un2.un.org/files/old_persons_spanish.pdf

Wang, Q. (2020). *CHOWTEST': module to perform Chow test for structural break*. http://fmwww.bc.edu/RePEc/bocode/c. Accessed 25 Nov 2020.

Welti-Chan, C., & Ramírez-Penagos, A. C. (2021). Conocimiento sociodemográfico y respuesta institucional a una pandemia. El caso de méxico. *Papeles de Poblacion, 27*(107), 103–163. https://doi.org/10.22185/24487147.2021.107.04

WHO. (2020a). *Management of ill travellers at Points of Entry (international airports, seaports, and ground crossings) in the context of COVID-19*. https://www.who.int/publications/i/item/10665-331512

WHO. (2020b). *Hoja de ruta del SAGE de la OMS para el establecimiento de prioridades en el uso de vacunas contra la COVID-19 en un contexto de suministros limitados. Conjunto de criterios para orientar la planificación y las recomendaciones posteriores en distintos con*. https://www.who.int/docs/default-source/immunization/sage/covid/sage-prioritization-roadmap-covid19-vaccines-es.pdf?sfvrsn=bf227443_36&download=true

Williams, F. M. K., Freidin, M. B., Mangino, M., Couvreur, S., Visconti, A., Bowyer, R. C. E., le Roy, C. I., Falchi, M., Mompeó, O., Sudre, C., Davies, R., Hammond, C., Menni, C., Steves, C. J., & Spector, T. D. (2020). Self-Reported Symptoms of COVID-19, Including Symptoms Most Predictive of SARS-CoV-2 Infection, Are Heritable. *Twin Research and Human Genetics, 23*(6), 316–321. https://doi.org/10.1017/thg.2020.85

Wolff, J. (2020). The Turbulent End of an Era in Bolivia: Contested Elections, the Ouster of Evo Morales, and the Beginning of a Transition Towards an Uncertain Future. *Revista de Ciencia Política (Santiago)*, *40*(2), 163–186. https://scielo.conicyt.cl/scielo.php?pid=S0718-090X2020005000105&script=sci_arttext

Zens, M., Brammertz, A., Herpich, J., Südkamp, N., & Hinterseer, M. (2020). App-Based Tracking of Self-Reported COVID-19 Symptoms: Analysis of Questionnaire Data. *Journal of Medical Internet Research, 22*(9), e21956. https://doi.org/10.2196/21956

Authors and Affiliations

Vladimir Pinto Saravia[1]

✉ Vladimir Pinto Saravia
   vladimir_pinto@hotmail.com

[1] El Colegio de México, CEDUA, Mexico City, México