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High prevalence of SARS-CoV-2 infection among food delivery riders. A case study from Quito, Ecuador

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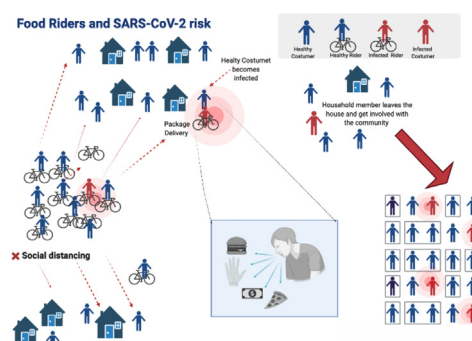
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HIGHLIGHTS

- Food delivery riders are potentially high risk population for SARS-CoV-2 infection.
- Food delivery riders from Quito (Ecuador) had high prevalence of SARS-CoV-2 infection.
- Risk of SARS-CoV-2 transmission associated to food delivery deserves public health attention.

GRAPHICAL ABSTRACT



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ABSTRACT

Aim: COVID-19 pandemic has posed an unprecedented pressure on health systems and economies worldwide. Delivery services have grown as an alternative source of revenue for many people. Consumers generally perceive that delivery services are safer than going into a restaurant, because they reduce exposure to other people and their risk of SARS-CoV-2 contagion. There are no studies analyzing viral load or the burden of COVID-19 within this population. This study aims to describe the presence of SARS-CoV-2 among food delivery riders in the city of Quito, Ecuador.

Study design: From July and August 2020, bike and motorbike riders self-employed in two of the main online delivery services in Quito, Ecuador, were invited for RT-PCR testing for SARS-CoV-2 detection during the compulsory lockdown due to the COVID-19 pandemic. The Center for Disease Control (CDC) 2019–Novel Coronavirus (2019-nCoV) RT-qPCR Diagnostic Panel was used to identify the presence of SARS-CoV-2 in nasopharyngeal swabs. All samples were processed in the BSL2 certified molecular biology laboratory at Universidad de Las Américas.

Results: A total of 22 out of 145 delivery workers (15.2%) tested positive for SARS-CoV-2. The majority of workers were men ($n = 138$), the average age of male workers was 32 years-old (± 7.3) and 38 years-old (± 10.6) for females. The presence of mild symptoms was reported in only 9 subjects (6%). The calculated viral load was higher among males with $1.31E+08$ copies/mL vs $2.30E+06$ in females, although this difference was not statistically significant (p value: 0.68, [CI: -53 to -79]).

Conclusions: The self-employed food delivery riders have a high incidence rate of SARS-CoV-2 infection in relation to the national average. It is important to point out that this is the first study of its kind in Latin-American and probably one of the very few in the world. The results emphasize the need for policy makers to look at the

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pandemic from as many population's sub-groups as possible. Delivery riders are a highly moving population that offer their services to a wide range of clients, including vulnerable populations such as the elderly or those less likely to leave their house for basic needs stoking.

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1. Introduction

COVID-19 pandemic has posed an unprecedented pressure on health systems and economies worldwide (Ortiz-Prado et al., 2020). With the global recommendation of keeping social distancing and the implementation of partial or total lockdowns many businesses like restaurants were forced to close. Consumers generally perceive that delivery services are safer than going into a restaurant, because reduce exposure to other people and their risk of SARS-CoV-2 contagion. In this scenario delivery services have grown as an alternative source of revenue for formal businesses but also for people inserted in the gig economy (Chang and Meyerhoefer, 2020). This led to the question of how safe is to receive food at home or if you can get COVID-19 from packaging and food; According to Food Standards Australia New Zealand (FSANZ), there is little evidence to support that COVID-19 can be transmitted through food or food packaging since European Food Safety Authority (EFSA) has stated that food is not likely a source or route of virus transmission (Tong, 2020).

Delivery workers have suddenly been thrust to the front lines of the coronavirus pandemic. Most of them use an app (like Uber Eats, Glovo, Mei tuan or Rappi) or a website to match with customers and provide their services. The increased mobility of delivery workers, most of them driving bikes or motorcycles, and the high number of personal contacts put their health also at risk during the COVID-19 pandemic. While keeping their income, delivery workers are vulnerable because cannot rely on a stable income and are usually excluded from the labor and social protections systems offered to formal employees (Apouey et al., 2020).

Some mass media have reported that delivery workers are at risk of exposure to illness at work at the same rate as nurses, social workers, and paramedics. Also, the US Occupational Safety and Health Administration reports that these workers may have increased risk of exposure to SARS-CoV-2, however, there is not enough evidence available on the risk of SARS-COV-2 infection in delivery workers (CDC, 2020). There are few case reports, one in Beijing China; a 47-year-old deliveryman offering services across a wide area of Beijing between June 1 and June 17 delivering around 50 orders per days (Ji, 2020; Liu and Cao, 2020), and another case reported in India where a pizza delivery man was positive for SARS-CoV-2, which had contact with 72 families and 17 delivery men who were quarantined (Clarín.com, 2020).

An interesting factor that might contribute to SARS-CoV-2 transmission is the role of the environmental and atmospheric condition in which the food riders deliver their packages (Zhu and Xin, 2020; Srivastava, 2020; Coccia, 2020a; Riddell et al., 2020). In urban areas, where air pollution, highly pedestrian traffic, reduced wind speed and atmospheric stability are common; the risk of having contaminated aerosols floating for longer time might represent a higher risk for contagium (Manisalidis et al., 2020; Coccia, 2020b; Bashir et al., 2020; Xu et al., 2020; Rosario Denes et al., 2020; Coccia, 2020c; Shen et al., 2021; Haque and Rahman, 2020; Coccia, 2020d; Sarkodie and Owusu, 2020). The lack of appropriate occupational health control measures among food riders and the highly risky behaviors in terms of mobility and social interaction put this population on the edge between work and safety.

In order to elucidate some of the current questions and contribute to a clear gap in knowledge, our study aims describe the prevalence of SARS-CoV-2 infection among food delivery riders in Quito, the capital city of Ecuador in Latin-American.

2. Study design

2.1. Research setting, sample and data

A Cross-sectional study to describe the incidence rate of SARS-CoV-2 infection among food delivery self-employed riders in Quito, Ecuador. The study was performed in this city from July to August 2020. Quito population in 2020 reached 1.9 inhabitants and its density 5401 people per km². The city is crossed by the equatorial line (−0.225219, −78.5248 0° 13' 31" South, 78° 31' 29" West) in the Western Andes mountain range. It covers around 423,000 ha and ranges from altitudes between 500 and 4790 m above sea level. The city's climate is "Cfb" (Marine West Coast Climate), according to the Köppen Climate Classification. The average temperature year-round in Quito is 14.4 °C (58.0 °F), which varies around the day, having an average relative humidity of 75%. In Quito and due to its elevation, wind speed increases during the summer (June–August), having an annual average of 6.8 Km/h.

According to the international developing index, Quito has a very high score of 0.821, a GDP of USD \$ 15,388 and an unemployment rate of 8.2% for 2019. In this city, at least 1700 self-employed riders are registered in two of the biggest food delivery App-based services.

A sample size calculation based on a margin error of <5% and a confidence level of 95% assuming a response distribution of 10% among the respondents yielded a sample of 128 riders in order to achieve significance. A non-probabilistic chain referral sampling technique was used to engage volunteer-to-volunteer's participation. We have contacted three of the main food delivery apps on Ecuador and only two of them agreed to invite their riders to voluntarily participate in the study. The human resources department of each company sent out an invitation and the explanatory package to every volunteer and the directions to the Universidad de las Americas (UDLA) molecular laboratory. Upon their acceptance, 145 subjects were positively recruited for a unique nasopharyngeal swab testing to detect the presence of SARS-CoV-2.

2.2. Measures of variables

The socio-demographic information was obtained from the official epidemiological record used by the local health authority and the Minister of Public health (MoH). The presence of infection and viral load were obtained from the nasopharyngeal swabs performed in the group of riders and a quantitative reverse transcription polymerase chain reaction RT-qPCR was used to identify the presence of SARS-CoV-2 infection.

2.3. Data analysis procedure

The CDC 2019–Novel Coronavirus (2019–nCoV) RT-PCR Diagnostic Panel was used to identify the presence of SARS-CoV-2 in nasopharyngeal swabs. All samples were processed in the BSL2 certified molecular biology laboratory at Universidad de Las Americas. Nasopharyngeal swabs were collected on 0.5 mL TE pH 8 buffer for SARS-CoV-2 diagnosis by RT-qPCR following an adapted version of the CDC protocol by using PureLink Viral RNA/DNA Mini Kit (Invitrogen, USA) as an alternate RNA extraction method and CFX96 BioRad instrument (Interim Guidelines for Collecting, n.d.; Freire-Paspuel et al., 2020a; Freire-Paspuel et al., 2020b; Freire-Paspuel et al., 2020c; Freire-Paspuel et al., 2020d; Freire-Paspuel and Garcia-Bereguain, 2020). Briefly, the CDC designed RT-qPCR FDA EUA 2019-nCoV CDC kit (IDT, USA) is based on

N1 and N2 probes to detect SARS-CoV-2 and RNase P as an RNA extraction quality control (Interim Guidelines for Collecting, n.d.; Freire-Paspuel et al., 2020a; Freire-Paspuel et al., 2020b; Freire-Paspuel et al., 2020c; Freire-Paspuel et al., 2020d; Freire-Paspuel and Garcia-Bereguain, 2020). Also, negative controls (TE pH 8 buffer) were included as control for carryover contamination, one for each set of RNA extractions, to guarantee that only true positives were reported. For viral loads calculation, the 2019-nCoV N positive control (IDT, USA) was used, provided at 200.000 genome equivalents/mL.

3. Results and discussion

A total of 22 out of 145 delivery staff have tested positive for SARS-CoV-2 through the RT-qPCR technique, yielding a point prevalence of 15.2%. The majority of delivers were men ($n = 138$) and the average age for men and women were 32 and 38 years of age, respectively (Fig. 1). The incidence proportion in men was 15.2% (21/138) and among women 28.6% (2/7). Most participants reported no symptoms related to COVID-19, mild symptoms were reported only by 9 subjects (6%).

The calculated viral load was higher among males with $1.31E+08$ copies/mL vs $2.30E+06$ in females, although this difference was not statistically significant (p value: 0.68, [CI: -53 to -79]) See details on Fig. 2.

Since the emergence of the SARS-CoV-2 pandemic, many activities were affected and economies worldwide were affected dramatically (Nicola et al., 2020). Confinement and social distancing pushed many business to the burden of their limits, having thousands of companies shutting down and increasing unemployment to dramatically high levels (Kawohl and Nordt, 2020). This situation forced millions of people to stay at home, slowing economies worldwide. In this sense, beside health workers, law enforcement officials and other very few job categories continue to work non-stop during the pandemic. One of those populations are self-employed from food deliveries online based companies.

Food delivery riders work all day to provide food and other services to people worldwide. These new types of self-employed riders are often male immigrants who are situated within intersectional and interlocking systems of global conflicts, massive immigration and intense time pressures by restaurants and customers (Lee, 2018). In Ecuador and other Latin American countries delivery riders are frequently Venezuelan immigrants that massively left their country during the last 3 years due to a dramatic economical crisis, sometimes working under abusive long hours shifts, and also suffering precarious economic situations and reduced access to health services (Martínez, 2019).

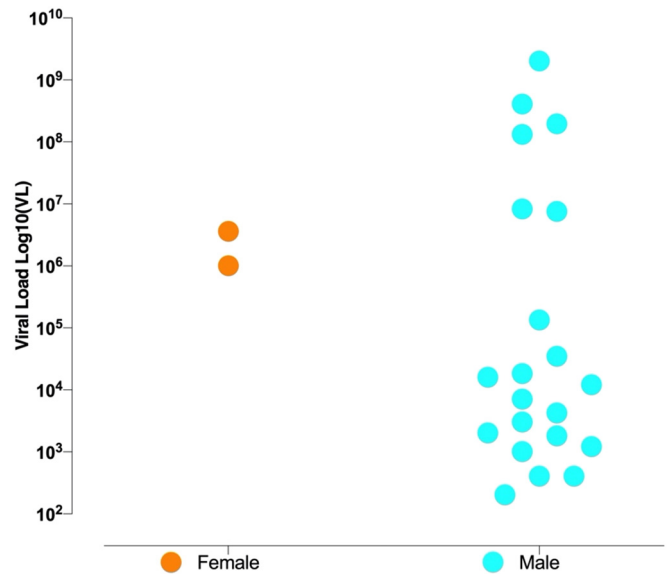


Fig. 2. Viral load of SARS-CoV-2 through RT-qPCR for 22 positive food delivery riders.

Our data shows a high prevalence up to 15.2% for SARS-CoV-2 infection among food delivery riders in Quito, Ecuador. These results suggest that food riders might have higher prevalence of SARS-CoV-2 infection than other workers, as it has been previously proposed (Nguyen and Vu, n.d.; WHO, 2020). In one recently published study, Ortiz-Prado et al., 2020 described the prevalence of COVID-19 among several professions, careers and occupations, and up to April 2020. Using their publicly available data we calculated that medical doctors have a point prevalence of 13.6%, politicians 4.7%, civil security personnel 3.2% and blue collar jobs 1.5% in relationship with the total number of available information about how many professionals are registered. In comparison with local urban prevalence rates reported, food riders seem to have higher attack rates than the rest of the population at risk. For instance, in the city of Quito the overall attack rate was reported to be 7.14% in November 2020 and for Guayaquil, the second biggest city in Ecuador, only 2.12% (Ortiz-Prado et al., 2021).

These results suggest that food delivery companies should perform SARS-CoV-2 tests on their employees, as they are constantly moving

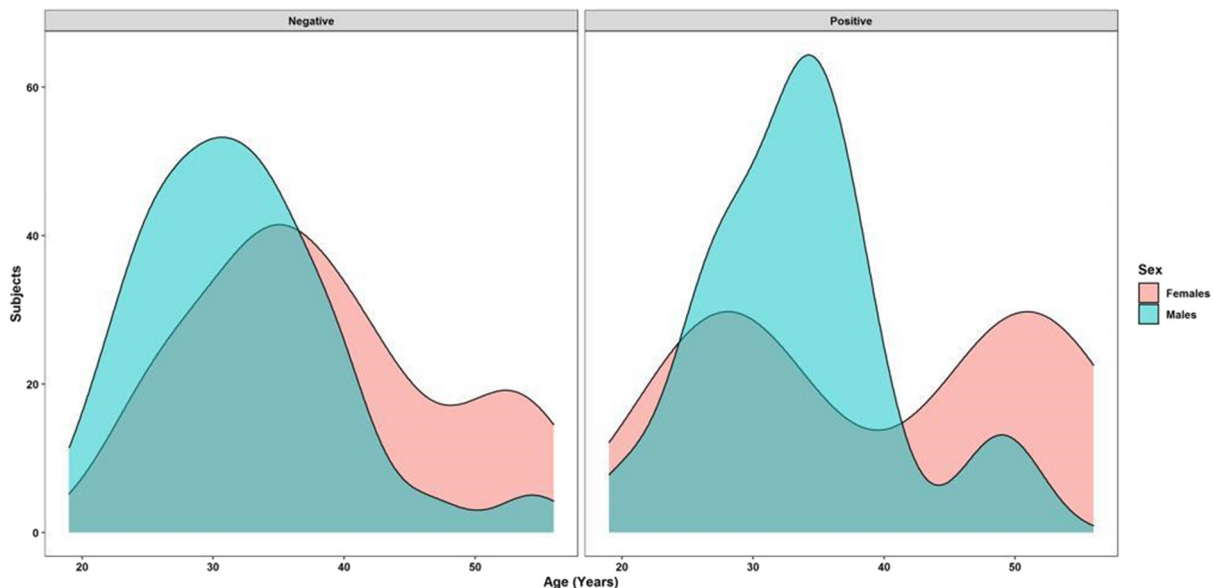


Fig. 1. Age and sex distribution of SARS-CoV-2 test positivity among the 145 food delivery riders included on the study.

and in contact with multiple people throughout their journey, to avoid SARS-CoV-2 spread. Unpublished information offered from one of the companies involved in our investigation reported an increase in more than 250% of their profits during the first three months of the total lockdown in Ecuador, scoring an average of 17 trips per rider during the same time. Although it is clear that the number of food delivery riders has increased significantly, very few reports have demonstrated their implications during this pandemic. For instance, a case report from India shows that a single delivery worker tested positive for SARS-CoV-2 in contact with 72 families that need to be quarantined (Clarín.com, 2020).

The proposed mechanisms for this unusually high prevalence of infection among food riders relies on several factors and residual co-factors that are hard to track. Although in the majority of scenarios delivery is done outdoors by a food rider wearing a mask, due to extenuation and the speed required to deliver on time, the riders might decrease the degree of their protection as the day continues. This is important to point out since it would be valuable to generate local or national recommendations and potential solutions to reduce the risk. For example, the delivery staff would be requested via rule/law to drop to food outside the door and inform the recipient and leave upon confirming its receipt by the client. Another option although highly implemented worldwide is to mandate online payments only. There are few studies that have shown the potential risk of handling money in terms of SARS-CoV-2 transmission (Harbourt et al., 2020; Riddell et al., 2020).

Around the world, different strategies have been proposed to guarantee the health of the delivery workers and of those who make use of their services, among these strategies, is Contact-free delivery, which is carried out in different ways as in the USA deliveries are left in the door of the house, or in Vietnam where delivery workers leave the meals at the designated position, standing 2 m away to await customers (Lee, 2018; Martínez, 2019; Nguyen and Vu, n.d.). Other strategies used are the strict use of new face masks, gloves, and hand sanitizers. Delivery workers should wear new face masks and gloves, and frequently apply hand sanitizers to minimize contamination with the novel coronavirus, the use of E-Wallet (i.e., digital) or credit card payment method to limit contact with delivery workers and it is also recommended that customers should discard the packaging as soon as possible and wash hands immediately after (Harbourt et al., 2020; Lee, 2018; Martínez, 2019; Nguyen and Vu, n.d.).

The World Health Organization (WHO) recommends that people and companies who work with breaths follow strict hygiene standards such as proper handwashing, use of alcohol-based hand sanitizers, providing personal protective equipment such as masks, hair nets, disposable gloves, frequent cleaning/disinfection of work surfaces and touchpoints such as door handles (WHO, 2020).

We found that food delivery riders are difficult to follow-up and track. Once the diagnosis was established, results were provided individually by email or cell phone number and the results were communicated anonymously to the hiring company. However, when we wanted to get more information about other sociodemographic variables, very few agreed to share such a detail. This situation might respond to their precarious situation and their immigration status that could jeopardize the follow-up and the obtainment of information.

One of the main limitations of our study is that is difficult to extrapolate our results to other cities in the world. First, not everywhere food riders share the same socio-demographic characteristics as in Quito. Second, the environmental and atmospheric conditions in which the riders work in Quito (low barometric pressure, high pollution, 75% humidity and high-speed winds during the summer) are not the same for other cities worldwide. So far, further studies are needed in order to conclude if food delivery is highly associated with an increased SARS-CoV-2 transmission or the social factors behind food riders are responsible for the reported significantly high prevalence of COVID-19 among food riders.

4. Conclusions

The high prevalence of SARS-Cov-2 found in riders in Quito showed how vulnerable this population might be, with higher prevalence than even healthcare workers. So, this group could represent a potential source of transmission of SARS into the community at the city of Quito if no diagnosis is implemented.

The food delivery companies that have participated in this study are probably taking actions to reduce transmission, nevertheless, the other companies out there should implement a frequent preventive testing scheme in their employees as well as develop strategies and provide tools for safe work for themselves and customers.

As the results show, these people, being asymptomatic, are not aware that they are infected, representing a health risk for both the company for which they work as well as the people who use their services, they are even a risk for their own families.

Since the results suggest that most of them are asymptomatic, we suggest more aggressive testing and contact tracing strategies in order to reduce the risk for other populations.

Ethical approval

All participants signed an informed consent to participate freely and voluntarily in the molecular diagnosis of SARS-CoV-2. In Ecuador diagnosis and testing for COVID-19 does not require IRB approval and anonymous data collected can be published without restrictions as long as data is anonymized. The University received a government approval for testing for SARS-CoV-2 within its facilities and addition to access to the epidemiological surveillance system VIEPI in Ecuador.

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CRediT authorship contribution statement

All authors participate on study design, data collection, writing and editing of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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