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Household transmission of SARS-CoV-2 (COVID-19) in Lima, Peru

Transmisión intra-hogar en personas infectadas por SARS-CoV-2 (COVID-19) en Lima, Perú

Transmissão intradomiciliar em pessoas infectadas por SARS-CoV-2 (COVID-19) em Lima, Peru

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Abstract

The study aimed to describe the characteristics of SARS-CoV-2 transmission among members of households with a confirmed primary case of COVID-19 in districts with low burden of cases in Lima, Peru, compared to a district with high burden. This was a retrospective study with a secondary database review. Information was collected from an epidemiological surveillance activity in close contacts (household members) in 52 households in Lima, with a single member with COVID-19. Reevaluation was conducted in 10 households. The study evaluated epidemiological and clinical variables and their association with the result of the rapid serological test (presence of IgG, IgM, or both). Secondary cases were found in 40 households, representing mean identification of 49.9% per household. Secondary attack rate in household members was 53% (125 cases), and symptomatic individuals accounted for 77.6% of cases (symptomatic/asymptomatic ratio: 3.5). Presence of fever and/or chills was found in 40% of persons with positive test results, followed by sore throat with 39.2%. Ageusia and anosmia were present in 22.4% and 20.8% of cases, respectively. When there was a primary case of COVID-19 in the household, the secondary attack rate was 53%; however, in an important proportion of households there were no positive cases other than the primary case. The epidemiological and clinical findings were consistent with reports from other international series.

COVID-19; Contact Tracing; Epidemiologic Surveillance Services

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Introduction

SARS-CoV-2 is an RNA virus belonging to the *Orthocoronavirinae* family, which also includes other causal agents of pandemics such as Middle East respiratory syndrome (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV) [1]. In Peru, the first case of COVID-19 was identified on March 6, 2020, and the first two deaths from the disease came 13 days later [2,3]. Three months later, the country had passed 260,000 cases and reported more than 8,700 deaths (Ministerio de Salud. Sala situacional COVID-19 Perú. https://covid19.minsa.gob.pe/, accessed on 08/May/2020).

One of the most important characteristics of COVID-19 is its transmissibility dynamics, due to its highly effective transmission mechanisms. The infectious agent usually spreads by the respiratory route or contact with secretions. Thus, human-to-human transmission has become the principal route of spread to be managed in this pandemic [4]. Previous studies have determined that SARS-CoV-2 has a mean basic reproduction number (R0) of 2.2, but the R0 can range from 1.4 to 6.5. The estimates can vary according to the study context [5,6].

Close contacts of cases such as family members, relatives, and friends are at the greatest risk of contracting the infection and can thus be sources of contagion for others in contact with them. This contagion chain is supported by the fact that a percentage of infected individuals can act as asymptomatic carriers of the disease, which hinders their identification by health systems [7].

An effective way to break the SARS-CoV-2 transmission chain is through epidemiological surveillance and follow-up of persons who were in close contact with a confirmed case [8,9]. This process is called contact study or "contact tracing". Some prior experiences have used these strategies to assess the transmission dynamics among household contacts of COVID-19 cases. A study in China reports a correlation between confirmed cases in other communities in Hubei province and the number of migrants in Wuhan, who usually came on family visits [10]. Liu et al. [11] showed that family reunions became transmission hotspots in some provinces of China and thus recommended that public health interventions should consider specific measures to reduce contact in household members.

Other studies have found that secondary attack rates increase by 7-10 times when studying only the persons living in the same dwelling with the primary case, compared to the rate calculated when including all individuals in contact with the primary case [12,13]. However, the evidence still differs between regions and countries where contact studies are performed.

In Latin America, deficient health systems and lack of economic resources add to the difficulty in tracing COVID-19 cases and contacts, which has proven to be an aggravating factor in the pandemic's progression [14]. Benitez et al. [15], in a recent analysis in five Latin American countries, suggest that strict contact tracing, as in Chile, is associated with sustained decreases in COVID-19 cases. In addition, contact tracing has been implemented late in the region and is still incomplete in countries with high mortality rates like Brazil, Ecuador, and Peru [16].

Centralism is an additional factor in Peru. The capital and Greater Metropolitan Lima concentrate approximately 60% of all cases in the country. Within Greater Metropolitan Lima, districts have been identified with high and low proportions of cases and which have varied over time (Ministerio de Salud. Sala situacional COVID-19 Perú. https://covid19.minsa.gob.pe/, accessed on 08/May/2020).

Although a previous study was identified with a preliminary analysis of the SARS-CoV-2 transmission dynamics in Lima [17], no analyses were found of information on activities that involved follow-up of close contact clusters, that is, persons living in the same household, considering the COVID-19 burden by districts of residence. The current study thus aims to describe the characteristics of SARS-CoV-2 infection among members of households with a confirmed primary COVID-19 case in districts with low burden of cases in Greater Metropolitan Lima, compared to a district with high burden.

Materials and methods

Study design and type

The study has a quantitative design of the observational and retrospective type.

Population and sample

The study population was defined as all the reporting forms with the results of COVID-19 rapid lateral flow immunoassay. The inclusion criterion was contacts with complete epidemiological forms with IgG/IgM results performed by personnel from the Peruvian National Institute of Health (INS, in Spanish), included in household epidemiological surveillance. The sample excluded forms that were not found in the search process or that belonged to persons that did not live in the same household as the primary case. The study is thus defined as census type.

Epidemiological surveillance

In the context of the pandemic's control and surveillance, the INS conducted an epidemiological surveillance activity of households with a single primary case of COVID-19 (identified by RT-PCR) from April 23 to May 2, 2020. This evaluation was conducted on a mean of 13.6 ± 3.7 days following the primary diagnostic test.

In order to avoid the inclusion of COVID-19 cases from contagion in environments outside the household, the activity was conducted in districts with lower burden in each of the four descentralized health areas in Lima, called Integrated Health Network Directions (DIRIS, in Spanish), until reaching the surveillance of 10 households per DIRIS. This was performed by obtaining the results of molecular tests (RT-PCR) recorded since April 9 in the NetLab system, version 2.0, of the Peruvian Ministry of Health (https://netlabv2.ins.gob.pe/Login).

The results were grouped by district of residence and were ordered by burden of cases with each of their DIRIS, after which intentional non-probabilistic selection was used to pick 10 households from the districts with the lowest burden of cases in each DIRIS. In the DIRIS corresponding to the city center of Lima (with the highest population density), additional households were considered. The evaluation also included the district of Greater Metropolitan Lima with the highest proportion of cases at the beginning of the surveillance. A total of 52 households were included in the study.

Subsequently, as part of the surveillance, the 12 households located in the DIRIS corresponding to the city center of Lima were reevaluated, on average 33.6 ± 2.7 days after the first evaluation.

The serological test used was Coretests COVID-19 IgM/IgG Ab Test (Core Technology Co., Beijing, China), a lateral flow immunochromatographic assay that qualitatively detects the presence of antibodies to SARS-Cov-2, with sensitivity and specificity to IgM/IgG of 97.6% and 100%, reported by the manufacturer. These values were verified by the INS though evaluations at the laboratory level, reporting 96.4% sensitivity and 96% specificity for both IgG and IgM [18].

Variables

The study addressed a principal variable called SARS-CoV-2 infection and defined as the presence of antibodies (IgM, IgG, or both) in persons with no previous test result (RT-PCR or serological test). Positive cases were classified in turn according to the presence/absence of symptoms.

Information was also collected on the number of household members, evaluation time, defined as time in days between delivery of the index case result and the evaluation; and time with the disease, defined as time in days (patient-reported) from the onset of symptoms to the day of evaluation.

The study also described the sociodemographic characteristics of household members (age, sex, presence of healthcare workers), and clinical characteristics (presence of symptoms and risk conditions). Symptoms included cough, sore throat, nasal congestion, fever, general malaise, shortness of breath, diarrhea, nausea/vomiting, headache, irritability/confusion, pain in general, among others. Risk conditions included age 60 years or older, hypertension, cardiovascular disease, type 2 diabetes

mellitus, obesity, asthma, chronic lung disease, chronic renal failure, immunosuppressive disease or treatment, cancer, pregnancy or postpartum, healthcare worker, or other conditions that the attending healthcare personnel consider relevant to record [19].

Statistical analysis

The descriptive statistical analysis of the data was carried out through determination of the frequency, percentage, mean, and standard deviation of the collected data. The evaluation was conducted differentially, expressing simple means for information from the subjects in general. Meanwhile, to identify the values for persons within each household, average measures were used, considering the variability existing in each household according to the density of members in it. The analyses were repeated for persons and households that were reevaluated in order to identify the changes occurred in time. The statistical software used was Stata version 16.0 (https://www.stata.com).

Ethical aspects

Since the current study used secondary data sources in the context of an epidemiological surveillance activity, no informed consent was required. The use of anonymous databases preserved the confidentiality of the participants' personal data, and no information was collected that would allow identification of the included persons. The study was approved by the Institutional Review Board of the INS (RD n. 256-2020-OGITT/INS).

Results

We evaluated the records for 236 persons, of whom 54.7% (n = 129) were women, with a mean age of 36.2 ± 20.1 years. Mean time between detection of the primary case and evaluation of contacts was 13.6 ± 3.7 days. Some 37.3% presented a risk condition (n = 88), the most frequent of which was age 60 years or older (n = 35, 39.8%), followed by hypertension (n = 20, 22.7%) and bronchial asthma (n = 14, 15.9%). Of all the persons, 68.6% presented some sign and/or symptom, especially sore throat (49.4%), while fever and/or chills and cough were present in 41.4%.

Of all the sample, 53% were identified as secondary cases based on positive results in the lateral flow immunochromatographic assay, with 15 persons that were IgM-positive only, 110 that were IgM+IgG-positive, and none that were IgG-positive only. Among the secondary cases, 77.6% were symptomatic, and the symptomatic/asymptomatic ratio in secondary cases was 3.5 (Table 1).

Ages were similar between persons classified by serological results (positive/negative) and by symptoms (symptomatic/asymptomatic). 40.2% of symptomatic cases and 32.1% of asymptomatic cases had some risk condition, the most frequent of which was age 60 years or older. The most frequent signs and symptoms in the positive cases were fever and/or chills (40%), sore throat (39.2%), cough (35.2%), headache (30.4%), and general malaise (28%). Ageusia and anosmia were present in 22.4% and 20.8% of cases, respectively. The type of immunoglobulin detected was similar between symptomatic and asymptomatic secondary cases (Table 2).

The 236 persons belonged to 52 households, with a density of 4.5 ± 2.5 members per household. Considering the variability in the number of household members, 54.1% of the members were women, 34.7% had some risk condition, and 68.1% presented some sign and/or symptom. On average, 49.9% of household members were identified as secondary COVID-19 cases; of the 40 households with secondary cases, all the members tested positive in 9 (22.5%). On average, 39.4% of members were symptomatic secondary cases, and the symptomatic/asymptomatic ratio was 3.8 in secondary cases (Table 3).

When evaluating the characteristics of households according to the members' test positivity, in those where all the members tested positive, 66.7% were women, while in those where all the members tested negative, this figure was 55%, compared to 50% where some members tested positive and others negative. The frequency of risk conditions was higher in households with more test-positive members (Table 4).

The reevaluation data referred to 40 persons distributed in 12 households, with an average age of 34.2 ± 17.2 years. Persons were reevaluated at 33.6 ± 2.7 days after the first evaluation. On average, 66.8% of the members were women, and 39.6% had risk conditions.

In the first visit, a mean of 1.9 ± 1.4 inhabitants per household had some sign and/or symptom (59.2%), while in the reevaluation this figure was 0.9 ± 0.5 (41.6%). In the first evaluation, there were 1.8 ± 1.5 positive cases per household (57%), while in the reevaluation this average was 2.0 ± 1.5 (65.6%). Thus, the ratio of positive cases in household members thus increased from 1.33 to 1.91. All IgM+IgG-positive individuals in the first evaluation were IgM+IgG-positive in the reevaluation.

The only case that was IgM-positive alone in the first evaluation was also IgG-positive in the second evaluation. In addition, three cases were identified that were initially negative and that tested positive for IgM and IgG in the second evaluation. The mean number of symptomatic positive cases per household in the first visit was 1.3 ± 1.4 (44.6%), compared to 0.8 ± 0.4 (37.4%) in the reevaluation. The ratio of positive symptomatic to asymptomatic cases changed from 3.60 to 1.33 (Table 5).

Table 1

Characteristics of persons evaluated in general. Lima, Peru.

	Persons in general (n = 236) n (%)
Age (years) [mean ± SD]	36.2 ± 20.1
Sex	
Male	107 (45.3)
Female	129 (54.7)
District of residence according to burden of cases	
Low burden	185 (78.4)
High burden	51 (21.6)
Presence of risk condition	
No	148 (62.7)
Yes	88 (37.3)
Risk condition identified *	
Diabetes	13 (14.8)
Chronic hypertension	20 (22.7)
Bronchial asthma	14 (15.9)
Renal failure	1 (1.14)
Cardiopathy	7 (8.0)
Obesity	9 (10.2)
History of pneumonia	2 (2.3)
Fibromyalgia	1 (1.1)
Anemia	3 (3.4)
Hypothyroidism	7 (8.0)
Tuberculosis	3 (3.4)
Cancer	4 (4.6)
Autoimmune disease	1 (1.1)
Healthcare worker	9 (10.2)
Age 60 years or older	35 (39.8)
Presence of COVID-19 signs and/or symptoms	
No	74 (31.4
Yes	162 (68.6)

(continues)

Table 1 (continued)

	Persons in general (n = 236) n (%)
Time with COVID-19 (days) [mean ± SD] **	11.8 ± 7.5
Signs and symptoms identified **	
Cough	67 (41.4)
Sore throat	80 (49.4)
NasalcCongestion	35 (21.6)
Shortness of breath	22 (13.6)
Fever/Chills	67 (41.4)
General malaise	56 (34.6)
Diarrhea	27 (16.7)
Nauseas/Vomiting	7 (4.3)
Headache	62 (38.3)
Irritability/Confusion	4 (2.5)
Pain	1 (0.6)
Anosmia	28 (17.3)
Ageusia	31 (19.1)
Test result	
Negative	111 (47.0)
Positive	125 (53.0)
Positive/Negative ratio	1.1
Immunoglobulin detected	
IgM Alone	15 (12.0)
IgM + IgG	110 (88.0)
IgG Alone	0 (0.0)
Type of positive cases	
Asymptomatic	28 (22.4)
Symptomatic	97 (77.6)
Ratio symptomatic/asymptomatic positive cases	3.5

SD: standard deviation.

* Values calculated considering only those with some risk condition;

** Values calculated considering only those with some sign and/or symptom.

Discussion

This study found a secondary attack rate among household members of 53%, which is higher than in other studies that assessed SARS-CoV-2 transmission in similar clusters. The study that obtained the most similar results was by Wu et al. [20], evaluating 148 close contacts, all household members of a primary case, in China. Their evaluation found a 32.4% secondary attack rate (95%CI: 22.4%-44.4%).

Other studies in China, United States, and South Korea found secondary attack rates in household members ranging from 4.6% to 17%. Importantly, these estimates are affected by the sample size, ranging from 151 to 2,370 household members with confirmed cases [12,21,22,23]. This discrepancy may be explained by social and cultural differences between the countries in which the studies were conducted, as well as between social distancing and quarantine measures applied by their respective states. No similar studies have been found in Latin America, so the true magnitude of the influence from these factors on the progression of COVID-19 transmission in households is not known.

Another explanation for these results is the time between detection of the primary and secondary cases, which in this study was an average of 13 days. Guan et al. [24], in follow-up of contacts living in

Table 2

Characteristics of persons with positive and negative results according to presence of symptoms.

	Negative person			Positive person		
	Without symptoms (n = 46) n (%)	With symptoms (n = 65) n (%)	Total (n = 111) n (%)	Without symptoms (n = 28) n (%)	With symptoms (n = 97) n (%)	Total (n = 125) n (%)
Age (years) [mean ± SD]	37.7 ± 18.9	33.1 ± 19.1	35.0 ± 19.1	39.5 ± 21.2	36.5 ± 20.9	37.2 ± 20.9
Sex						
Male	22 (47.8)	31 (47.7)	53 (47.8)	11 (39.3)	43 (44.3)	54 (43.2)
Female	24 (52.2)	34 (52.3)	58 (52.2)	17 (60.7)	54 (55.7)	71 (56.8)
Presence of risk condition						
No	24 (52.2)	47 (77.3)	71 (64.0)	19 (67.9)	58 (59.8)	77 (61.6)
Yes	22 (47.8)	18 (27.7)	40 (36.0)	9 (32.1)	39 (40.2)	48 (38.4)
Risk condition						
Anemia	1 (2.2)	0 (0.0)	1 (0.9)	0 (0.0)	2 (2.1)	2 (1.6)
History of pneumonia	0 (0.0)	1 (1.5)	1 (0.9)	1 (3.6)	0 (0.0)	1 (0.8)
Bronchial asthma	4 (8.7)	2 (3.1)	6 (5.4)	1 (3.6)	7 (7.2)	8 (6.4)
Cancer	1 (2.2)	1 (1.5)	2 (1.8)	1 (3.6)	1 (1.0)	2 (1.6)
Cardiopathy	1 (2.2)	2 (3.1)	3 (2.7)	1 (3.6)	3 (3.1)	4 (3.2)
Diabetes	5 (10.9)	1 (1.5)	6 (5.4)	1 (3.6)	6 (6.2)	7 (5.6)
Autoimmune disease	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	1 (0.8)
Fibromyalgia	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	1 (0.8)
Age 60 years or older	7 (15.2)	5 (7.7)	12 (10.8)	6 (21.4)	17 (17.5)	23 (18.4)
Chronic hypertension	6 (13.0)	5 (7.7)	11 (9.9)	3 (10.7)	6 (6.2)	9 (7.2)
Hypothyroidism	3 (6.5)	2 (3.1)	5 (4.5)	0 (0.0)	2 (2.1)	2 (1.6)
Renal failure	1 (2.2)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)
Obesity	3 (6.5)	2 (3.1)	5 (4.5)	1 (3.6)	3 (3.1)	4 (3.2)
Healthcare worker	1 (2.2)	2 (3.1)	3 (2.7)	1 (3.6)	5 (5.2)	6 (4.8)
Tuberculosis	0 (0.0)	2 (3.1)	2 (1.8)	0 (0.0)	1 (1.0)	1 (0.8)
Immunoglobulin detected						
IgM alone	-	-	-	3 (10.7)	12 (12.4)	15 (12.0)
IgM + IgG	-	-	-	25 (89.3)	85 (87.6)	110 (88.0)
IgG alone	-	-	-	0 (0.0)	0 (0.0)	0 (0.0)

SD: standard deviation.

the same household, found that 13 days after detection of the first case, more than half of the secondary cases had already been identified. Likewise, Qian et al. [25] found 88.8% detection of secondary cases in the same household, in contact tracing conducted in China.

The epidemiological characteristics of secondary cases in the current study showed a mean age of 36.1 ± 20.1 years, and 54.7% of cases were females. This distribution is consistent with the systematic review by Lovato & De Phillips [26], which found 42.5% of cases in males and a mean age of 49.1 years. It is also similar to reports by the Peruvian National Center for Epidemiology and Disease Prevention and Control (CDC-Peru), which mentioned that 59.9% of cases in Peru were 30-59 years of age and 41.8% were males [27].

Risk conditions were reported by 38.4% of positive cases, according to the prevailing definitions [28]. The most frequent risk condition was age 60 years or older (18.4%), consistent with findings by CDC-Peru (17.3% of cases 60 years or older) [27]. Davies et al. [29] also estimated that 69% of cases in older adults presented clinical symptoms, while susceptibility to the infection decreased to half in persons under 20 years.

Table 3

Characteristics of the household composition (household members).

Characteristics of household members	Households in general (n = 52)
Household members *	4.5 ± 2.5
Age (years) *	36.2 ± 20.1
Sex (%)	
Male	45.9
Female	54.1
Household members with presence of comorbidities (%)	
No	65.3
Yes	34.7
Household members with presence of signs and/or symptoms (%)	
No	31.9
Yes	68.1
Time with COVID-19 (days) *	12.1 ± 7.3
Result of rapid serological test in household members	
Negative	50.1
Positive	49.9
IgM in household members (%)	
Negative	50.1
Positive	49.9
IgG in household members (%)	
Negative	57.1
Positive	42.9
Households according to positive cases [n (%)]	
Households where all members tested negative	12 (23.1)
Households where at least one member tested positive	40 (76.9)
Households with negative and positive members	31 (77.5)
Households where all members tested positive	9 (22.5)
Households with positive cases according to presence of signs and symptoms [n (%)]	
Households where at least one member was asymptomatic positive	11 (76.9)
Households where at least one member was symptomatic positive	35 (23.1)
Household ratio symptomatic/asymptomatic, with at least one positive member	3.2
Distribution of members according to results per household (%)	
Negative members per household	50.1
Asymptomatic positive members per household	10.5
Symptomatic positive members per household	39.4
Ratio symptomatic/asymptomatic positive cases per household	3.8

Note: percentage values correspond to the mean percentage of the characteristic in the household members.
* Values correspond to the mean of the characteristic in the household members with presence of some sign and/or symptom.

Other risk conditions reported in secondary cases were hypertension (7.2%), bronchial asthma (6.4%), and diabetes (5.6%). Previous studies report divergent results on the frequency of cases of hypertension in COVID-19 patients, with figures ranging from 1.9% [30] to 17.4% [26], while presence of bronchial asthma ranged from 8.8%-12.5% [31,32], similar to the current study and reports in Greater Metropolitan Lima (18%-19%) in other studies [33,34]. Finally, the frequency of type 2 diabetes mellitus in the current study is consistent with Tabata et al. [30], although higher than reported in other studies, in which the frequencies are 3% on average [26,35].

Table 4

Characteristics of household composition (household members) according to the members' test results.

	Households with all negative members (n = 12)	Households with positive and negative members (n = 31)	Households with all positive members (n = 9)
Number of persons	41	162	33
Members per household *	3.4 ± 2.0	5.2 ± 2.3	3.7 ± 3.1
Age (years) *	36.4 ± 18.9	36.8 ± 20.3	33.0 ± 20.7
Sex (%)			
Male	45.0	50.0	33.3
Female	55.0	50.0	66.7
Household members with presence of signs and/or symptoms (%)			
No	52.0	28.6	16.4
Yes	48.0	71.4	83.6
Time with COVID-19 (days) *	25.7 ± 4.9	25.0 ± 8.2	21.8 ± 6.5
Household members with risk condition (%)			
No	70.5	64.1	62.7
Yes	29.5	35.9	37.3
Households with some member who is a healthcare worker	4	4	2

Note: percentage values correspond to the mean percentage of the characteristic in the household members.

* Values correspond to the mean of the characteristic in the household members with presence of some sign and/or symptom.

Meanwhile, the most frequently reported triad of symptoms was fever, sore throat, and cough, observed in approximately 40%-50% of positive symptomatic cases. These findings are consistent with previous studies evidencing that fever and cough were the most frequent symptoms, present in up to 80% of cases [26,36]. Bi et al. [21] found a statistically significant relationship with a prevalence ratio of 3.06 (95%CI: 1.69-5.49) between fever and detection of COVID-19. While this study did not find a relationship between specific symptoms and test positivity (IgG and/or IgM), research on the natural history of this disease indicates that the appearance of IgM prior to IgG occurs during the first to second week after the onset of symptoms [37]. However, in the current context, the appearance of suggestive signs and symptoms such as those mentioned should lead to a reasonable suspected diagnosis, with the decision to apply a confirmatory test.

In addition, 22.4% of symptomatic cases presented ageusia and 20.8% presented anosmia. The evidence is still not clear concerning the frequency of these findings in COVID-19 cases. On the one hand, some studies estimate their presence in more than 50% of cases [38]. However, this is not backed by evidence from CDC-Peru, which reports 1.1% of anosmia and 0.3% of ageusia [27]. There was an important potential information bias, given that these symptoms were not routinely investigated in cases. However, 92.9% and 90.3% of contacts with these symptoms tested positive for COVID-19 antibodies. Patel et al. [38] reported that 58% of household contacts in patients with anosmia and COVID-19 also reported symptoms of the disease and anosmia. Future studies should evaluate the characteristics better in relation to the appearance of these symptoms and SARS-CoV-2 transmissibility.

This study found 22.4% of asymptomatic positive cases, a rate similar to the 29% reported by CDC-Peru [27]. This is also consistent with other contact tracing studies, such as Bi et al. [21], in China, showing 20% asymptomatic secondary cases and Cheng et al. [39], in Taiwan, reporting 18.2% asymptomatic secondary cases.

Meanwhile, reevaluation of cases concluded that although the proportion of persons with symptoms decreased, the ratio of positive cases increased from 1.33 to 1.91. This is consistent with the

Table 5

Variation in characteristics of persons in general and household members in the first evaluation and reevaluation.

	First evaluation		Reevaluation	
	EEvaluation of persons (n = 40) Frequence (%)	Evaluation of household members (n = 12) Mean ± SD (%)	Evaluation of persons (n = 40) Frequence (%)	Evaluation of household members (n = 12) Mean ± SD (%)
Age (years)	34.2 ± 17.2	-	-	-
Sex				
Male	14 (35.0)	1.2 ± 0.9 (33.2)	-	-
Female	26 (65.0)	2.2 ± 1.6 (66.8)	-	-
Presence of risk condition				
No	24 (60.0)	2.0 ± 1.5 (60.4)	-	-
Yes	16 (40.0)	1.3 ± 1.4 (39.6)	-	-
Presence of signs and/or symptoms				
No	17 (42.5)	1.4 ± 1.2 (40.8)	29 (72.5)	2.4 ± 2.1 (58.4)
Yes	23 (57.5)	1.9 ± 1.4 (59.2)	11 (27.5)	0.9 ± 0.5 (41.6)
Test result				
Negative	19 (47.5)	1.6 ± 1.7 (43.0)	16 (40.0)	1.3 ± 1.7 (34.4)
Positive	21 (52.5)	1.8 ± 1.5 (57.0)	24 (60.0)	2.0 ± 1.5 (65.6)
Ratio positive/negative persons	1.1	1.3	1.5	1.9
Immunoglobulin detected				
IgM Alone	1 (2.5)	0.1 ± 0.3 (8.3)	0 (0.0)	0.0 ± 0.0 (0.0)
IgM + IgG	20 (50.0)	1.7 ± 1.6 (48.7)	24 (60.0)	2.0 ± 1.5 (65.6)
IgG Alone	0 (0.0)	0.0 ± 0.0 (0.0)	0 (0.0)	0.0 ± 0.0 (0.0)
Type of secondary cases				
Asymptomatic	5 (12.5)	0.4 ± 0.7 (12.4)	14 (35.0)	1.2 ± 1.4 (28.2)
Symptomatic	16 (40.0)	1.3 ± 1.4 (44.6)	10 (25.0)	0.8 ± 0.4 (37.4)
Ratio symptomatic/ asymptomatic positive persons	3.2	3.6	0.7	1.3

SD: standard deviation.

reevaluation time (more than 30 days on average), because the sensitivity of antibody detection in the population increases in proportion to the disease time [40]. However, no major number of seroconversions was found in person that tested negative in the first evaluation.

This study also characterized households as measurement units, adjusting the epidemiological indicators according to the household´s density. This is important in a study of contacts in specific clusters such as dwellings, especially in a non-random selection mode, as in this case. In 23.1% of the households evaluated, no positive case was found; there was a mean density of 4.5 ± 2.5 persons per household and 3.7 ± 3.1 persons in households where all members tested positive. This density was similar and would not explain the absence of more infection in contacts in these households. Jing et al. [23] conducted a similar experiment and found 65% of households without positive cases, with a median of 6 (4,10) household members. However, they did not analyze the characteristics of households with positive cases.

In addition, and as expected, an important difference was found in the percentage of persons with symptoms in households with all positive contacts, compared to households with all negative contacts (83.6% vs. 48%).

As for differences between households in districts with low burden of COVID-19 cases and households in districts with high burden, in the former group, the weighted percentage of contacts with signs and symptoms and of contacts with positive test results was lower.

This study has some important limitations. First, the selection of households in the epidemiological surveillance activity was done by convenience, so the results cannot be extrapolated to the general population. There was no temporal component, which does not allow determining whether the cases called "asymptomatic" were in fact pre-symptomatic cases. The reevaluation activity could not be performed in all initially included households, which adds an important selection bias and decreases the external validity of the conclusions that can be obtained from these data. Even so, since no similar studies were found in Latin America, this study presents results that can serve as the basis for future studies that generate knowledge on SARS-CoV-2 transmission dynamics in households

Although the serological tests used in this study are backed by the official regulatory authority (INS) through laboratory assessments, in Peru there is only one field study that employs this type of test for this purpose. However, this test used another brand (Zhejiang Orient Gene Biotech Co., Huzhou, China) and did not define values for diagnostic yield.

Finally, the study concludes that with a primary case of COVID-19 in the household, the secondary attack rate for this infection was 53%. Still, in 23% of the households evaluated there were no positive cases beyond the primary case. The epidemiological and clinic characteristics found in this case agreed with reports in other international series. Likewise, the proportion of asymptomatic cases (22.4%) is consistent with evidence from previous publications and national epidemiological data in Peru. The study further evidenced the persistence of positive IgM in the reevaluation of cases 30 days later.

Contributors

All authors particpated on research project's conception, data analysis and interpretation, writing of the article, relevant critical revision of the intellectual content, approval of the final version for publication, and are responsable for all aspects of the work.

Additional informations

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Resumen

El objetivo fue describir las características de la infección por SARS-CoV-2 entre miembros de hogares, con un caso confirmado primario de COVID-19, en distritos de baja carga de casos en Lima, Perú, en comparación con un distrito de alta carga. Estudio retrospectivo de revisión de base de datos secundaria. Se recolectó información proveniente de una actividad de vigilancia epidemiológica en contactos cercanos (cohabitantes), en 52 hogares de Lima, con un solo miembro con COVID-19. En 10 hogares se realizó una reevaluación. Se evaluaron variables epidemiológicas y clínicas; y su asociación con el resultado a la prueba serológica rápida (presencia de IgG, IgM o ambas). En 40 hogares se encontraron casos secundarios, lo que representa un 49,9% de identificación en promedio por hogar. Se encontró una tasa de ataque secundaria entre cohabitantes de 53% (125 casos), siendo sintomáticos un 77,6% de casos (razón sintomáticos/asintomáticos: 3,5). La presencia de fiebre y/o escalofríos se encontró en el 40% de las personas con resultado positivo, seguido del dolor de garganta en el 39,2%. La ageusia y anosmia estuvieron presentes en el 22,4% y 20,8% de los casos, respectivamente. Al tener un caso primario de COVID-19 en el hogar, la tasa de ataque secundaria de esta infección es de 53%; sin embargo, en una proporción importante de hogares evaluados no hubo un caso positivo, más allá del caso primario. Las características epidemiológicas y clínicas encontradas en este caso estuvieron acorde a lo ya reportado en otras series internacionales.

COVID-19; Trazado de Contacto; Servicios de Vigilancia Epidemiológica

Resumo

O objetivo foi descrever as características da infecção por SARS-CoV-2 entre os membros de domicílios, com um caso primário confirmado de COVID-19, em distritos com baixa carga de casos em Lima, Peru, em comparação com um distrito com alta carga. Estudo retrospectivo de revisão de banco de dados secundário. As informações foram coletadas em uma atividade de vigilância epidemiológica em contatos próximos (coabitantes), em 52 domicílios em Lima, com um único membro com COVID-19. Foi realizada uma reavaliação em 10 domicílios. Variáveis epidemiológicas e clínicas foram avaliadas; e sua associação com o resultado do teste sorológico rápido (presença de IgG, IgM ou ambos). Os casos secundários foram encontrados em 40 domicílios, representando uma taxa média de identificação de 49,9% por domicílio. Foi encontrada uma taxa de ataque secundário entre coabitantes de 53% (125 casos), com 77,6% dos casos sendo sintomáticos (relação sintomático/assintomático: 3,5). A presença de febre e/ou calafrios foi encontrada em 40% das pessoas com resultado positivo, seguida de dor de garganta em 39,2%. Ageusia e anosmia estiveram presentes em 22,4% e 20,8% dos casos, respectivamente. Quando há um caso primário de COVID-19 em casa, a taxa de ataque secundário para essa infecção é de 53%; No entanto, em uma proporção significativa dos domicílios avaliados não houve caso positivo, além do caso primário. As características epidemiológicas e clínicas encontradas neste caso foram consistentes com o que já foi relatado em outras séries internacionais.

COVID-19; Busca de Comunicante; Serviços de Vigilância Epidemiológica

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