



## Short Communication

## SARS-CoV-2-related mortality in a rural Latin American population



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## ABSTRACT

A sudden increase in adult mortality associated with respiratory diseases was noticed in Atahualpa (a rural Ecuadorian village), coinciding with the introduction of SARS-CoV-2 in the region. From a total of 1,852 individuals aged  $\geq 18$  years, 40 deaths occurred between January and June, 2020. In addition, a seroprevalence survey showed that 45% of the adult population have SARS-CoV-2 antibodies. Verbal autopsies revealed SARS-CoV-2 as the most likely cause of death in 29 cases. The mean age of suspected or confirmed SARS-CoV-2 cases was  $76.9 \pm 12.1$  years, while that of those dying from unrelated causes was  $60.3 \pm 20.4$  years ( $p=0.003$ ). The overall mortality rate was 21.6 per 1,000 population (95% C.I.: 15.9 – 29.2), almost three-quarters of it due to SARS-CoV-2 (15.7 per 1,000; 95% C.I.: 11 – 22.4). This configures a 266% of excess mortality when compared to 5.9 per 1,000 (95% C.I.: 3.3 – 10.6) deaths from other causes. When SARS-CoV-2 mortality rate was calculated in individuals aged  $\geq 60$  years, it raised up to 68.9 per 1,000 (95% C.I.: 47.8 – 98.4). After peaking in April and May, mortality significantly decreased. It is possible that the high proportion of infected individuals and the resulting herd immunity contributed to the observed reduction in mortality.

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## Introduction

The novel Coronavirus Disease 2019 pandemic, caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), has claimed the lives of more than 600 thousand people (Anon., 2020). Highly prevalent in urban centers of China, USA, and European countries, the disease has spread to Africa and Latin America, where rural populations are especially vulnerable because of multiple factors inherent to under-development (Zhao et al., 2020; Caicedo-Ochoa et al., 2020; Miller et al., 2020). Despite the vast information on SARS-CoV-2 published from urban centers, there is little or nil evidence about the mortality rate of individuals with SARS-CoV-2 in remote rural settings.

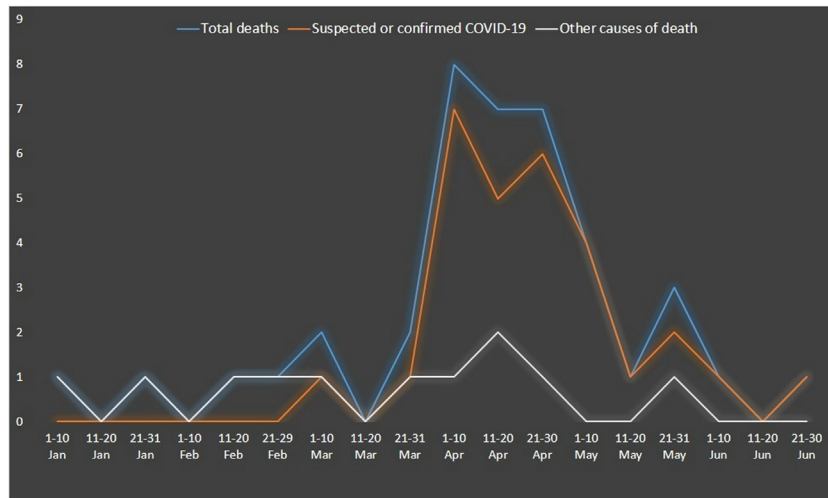
A sudden increase in adult mortality associated with respiratory diseases was noticed in Atahualpa, a rural Ecuadorian village ( $2^{\circ}18'S$ ,  $80^{\circ}46'W$ ), coinciding with the introduction of SARS-CoV-2 in the region (Hallo et al., 2020). Such deaths started on March 2020, reached a peak on April and May, and subsequently declined during June. Here, we report SARS-CoV-2 mortality rates in Atahualpa residents aged  $\geq 18$  years.

## Methods

Departing from the archives of the Atahualpa Project, we obtained data from our last census of the adult population, registered deaths occurring during the first semester of 2020, and reported the results of a door-to-door seroprevalence survey conducted during May, 2020 (Del Brutto et al., 2020). Deaths were classified in SARS-CoV-2-related and unrelated (based on verbal autopsies and confirmatory tests). Verbal autopsies findings were categorized according to World Health Organization operational definitions for suspected COVID-19 case, as follows: 1) acute febrile

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**Figure 1.** Mortality in individuals aged 18 years or more in Atahualpa from January to June, 2020, considering total deaths, as well as those related to SARS-CoV-2, and to unrelated causes.

respiratory illness and exposure of community transmission to COVID-19 disease during the 14 days prior to symptom onset; 2) any acute respiratory illness and contact with a confirmed or probable COVID-19 case in the last 14 days; and 3) severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease and requiring hospitalization) in the absence of an alternative diagnosis (World Health Organization, 2020). Mortality rates for the entire cohort and for the subset of older adults (aged  $\geq 60$  years) were calculated.

## Results

A door-to-door survey of Atahualpa residents (December, 2019), conducted as part of the Atahualpa Project cohort study (Del Brutto et al., 2018), revealed 1,852 individuals aged  $\geq 18$  years, 392 of whom were aged  $\geq 60$  years. Forty deaths occurred between January and June, 2020. Verbal autopsies – provided by family related households members – revealed SARS-CoV-2 as the most likely cause of death in 29 cases (World Health Organization, 2020), including five confirmed SARS-CoV-2 deaths (where the individuals had diagnostic tests performed at a local hospital). All the 24 individuals who died with suspected COVID-19 disease had fever and respiratory symptoms and entered into WHO Category 2, including 19 who had seropositive household members and five reporting frequent contact with seropositive neighbors.

Other causes of death (cancer, chronic liver failure, head trauma and suicide) occurred in the remaining 11 cases. In January and February there were four deaths, all unrelated to SARS-CoV-2. In March, two of four deaths were from suspected SARS-CoV-2 infection. In April there were 22 deaths, 18 of which were related to suspected or confirmed SARS-CoV-2 infections, as were seven out of eight deaths in May. The two deaths in June were confirmed SARS-CoV-2 cases.

The mean age of the 29 suspected or confirmed SARS-CoV-2 cases was  $76.9 \pm 12.1$  years, while that of those dying from unrelated causes was  $60.3 \pm 20.4$  years ( $p = 0.003$ ). Twenty-seven out of the 29 deaths likely related to SARS-CoV-2 were individuals aged  $\geq 60$  years, as were seven out of 11 deaths from unrelated causes ( $p = 0.039$ ).

The overall mortality rate in Atahualpa residents aged  $\geq 18$  years was 21.6 per 1,000 population (95% C.I.: 15.9 – 29.2), almost three-quarters of it due to SARS-CoV-2 (15.7 per 1,000; 95% C.I.:

11 – 22.4). This configures a 266% of excess mortality when compared to 5.9 per 1,000 (95% C.I.: 3.3 – 10.6) deaths from other causes. When SARS-CoV-2 mortality rate was calculated in the subset of individuals aged  $\geq 60$  years, it raised up to 68.9 per 1,000 (95% C.I.: 47.8 – 98.4).

## Discussion

In Atahualpa, SARS-CoV-2 rapidly spread across the village, markedly increasing mortality during April and May, 2020 (Figure 1), and infecting 45% of the adult population, in just a few months (Del Brutto et al., 2020). During a four-month period, 1.6% of the entire adult population of Atahualpa, including 6.9% (27/392) of older adults, died from SARS-Cov-2-related causes. After peaking in April and May, however, mortality significantly decreased. Since preventive measures are poorly endorsed by locals, the high proportion of infected individuals and the resulting herd immunity may have contributed to the observed reduction in mortality (Britton et al., 2020).

Atahualpa's mortality scenario is typical of closed populations where inhabitants are immunologically naïve to a rapidly spreading pathogen. To the immunological naivety of these populations, it must be added the adverse circumstances in which they live regarding inadequacy of control measures, poor social determinants of health and inadequate access to medical care. Rural communities of Latin America are not prepared for this pandemic (Miller et al., 2020; Amigo, 2020). Further studies in rural populations are needed to get more insights on the pattern of mortality of individuals with SARS-CoV-2 living in remote settings.

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## Ethical approval

The Independent Review Board of Universidad Espíritu Santo (IORG: 0010320; FWA: 00028878) approved the study.

## Conflicts of interest

The authors declare that they don't have any conflict of interest to disclose.

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