On the increasing role of older adolescents and younger adults during the SARS-CoV-2 epidemic in Mexico, April 20 – May 24, 2020

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Abstract

Background: The SARS-CoV-2 epidemic in Mexico is growing, and there is uncertainty regarding the role that different age groups play in propagating the epidemic.

Methods: We used data on hospitalizations with confirmed SARS-CoV-2 infection from the Mexican Ministry of Health in ten 5-year age groups: 10-14through 55-59 years. For each age group g, we computed the proportion E(g) of individuals in that age group among all hospitalized cases aged 10-59 years during the early period (between April 20 – May 3, 2020), the corresponding proportion L(g) during the later periods (May 11-24), as well as the relative risk RR(g)= L(g)/E(g). For each pair of age groups g1,g2, RR(g1)>RR(g2) is interpreted as a relative increase in SARS-CoV-2 infections in the age group g1 compared with g2 for the later vs. early period.

Results: The highest RR estimates belong to persons aged 15-19 years (RR=1.93(95% CI (1.19,3.12)) and 20-24 years (RR=1.40(1.07,1.83)). The RR estimates in persons aged over 30 years were significantly lower compared to persons aged 15-24 years.

Conclusions: Our results suggest a temporal increase in the incidence of SARS-CoV-2 infection in older adolescents and younger adults compared to other age groups. Targeted interventions, particularly public health messaging at those age groups to increase knowledge and risk awareness may be considered.

Introduction

The SARS-CoV-2 epidemic in Mexico is growing, with over 120,000 cases and 14,000 deaths recorded by June 8, 2020 [1]. Mexico introduced national physical distancing measures on March 23rd which included avoiding the presence high-risk individuals in the workplace and public areas, closing schools and non-essential businesses, limiting government activities to fundamental functions, and a ban on public gathering of more than 100 persons [2]. On March 31st, the maximum for public gatherings was reduced to 50 and a call was made for a national shelter-in-place until May 30th [3].

Under the current physical distancing measures implemented in Mexico, mixing patterns for individuals in different age groups may be quite different compared to regular mixing patterns, both in terms of the overall reduction in mixing, as well as the relative reduction in mixing for different age groups, as it was the case in other countries [4,5]. Also, similar to other low- and middle-income countries, a sizeable proportion of Mexico's population are relatively young informal workers who live from day to day for whom shelter-in-place policies may represent a significant economic burden. Overall, it is unknown what age groups play the leading role in propagating the epidemic in Mexico. Serological studies in different regions in England, as well as in a German town suggest that the highest rates of infection belong to older adolescents and younger adults [6,7], while a serological study in Belgium suggests that persons aged 20-30 years have the highest seroprevalence estimate in persons under the age of 80 years [8] (with the oldest individuals likely affected by outbreaks in long-term care facilities). We also note that the relative role of younger adults and older adolescents during the SARS-CoV-2 epidemic in Germany increased following the introduction of physical distancing measures [9]. In Geneva, Switzerland, a study involving repeated serology found that the rate of infection in persons aged over 50 years was significantly lower than in younger age groups, with the highest point estimate for infection rates belonging to persons aged 20-49 years [10]. On the other hand, a serological study in New York state found similar rates of infection in different age groups of adults [11]. A serological study in Spain showed higher rates of infection in older individuals compared to younger ones [12]; at the same time, the rates in Spain might have been affected by the substantial prevalence of multi-generational families, and by the fact that non-essential worker were allowed to work during the first phase of the lockdown, with employment rates in middle-age adults being quite higher than in younger ones.

The role of different age groups may change during the course of an epidemic due to changing mixing patterns, including changes that take place when physical distancing measures are present due to fatigue and other factors. Here, we estimate temporal changes in SARS-CoV-2 incidence by age group between April 20 – May 24 in Mexico. We applied the methodology developed earlier [9,13,14] to assess the changes in the role of different age groups of individuals between the age of 10-59 years during the epidemic. We used data on hospitalized cases in different age groups with laboratory confirmed SARS-CoV-2 infection to minimize the effect of temporal changes in case-ascertainment. The goal was to assess whether the role of certain age groups was increasing during the more recent stages of the epidemic, with such information could aid in targeted public health messaging directed at certain age groups.

Methods

We used publicly available database from Mexico's Ministry of Health on hospitalized cases in different age groups with laboratory confirmed SARS-CoV-2 infection. The dataset used for this analysis was downloaded on June 8, 2020. Since we used publicly available data no informed consent sought.

We applied a previously described procedure [9,13,14] to quantify time-varying changes in the proportion of a given age group among confirmed SARS-CoV-2 hospitalizations. We selected the early period to be April 20- May 3 because the earlier numbers of cases in certain age groups were limited and may have rendered our estimates unstable. For the later period we chose May 11-24 because there was a lag in reporting test results, with the more recent time period not included. We included laboratory confirmed hospitalizations in ten 5-year age groups: 10-14 years through 55-59 years. We excluded non-hospitalized cases because testing for non-severe COVID-19 may have changed over time for different age groups. Older adults were not included in the analysis because of potential temporal changes in ascertainment, as well as presence of some hospitalizations stemming from infections that do not reflect community transmission (e.g. infections in long-term care facilities , with rates of infection in those facilities being quite higher than in the corresponding age groups in the community). We excluded children aged under 10 years for two reasons. First, ascertainment of infection in those age groups might have changed with time as more severe episodes in younger children appeared as the epidemic progressed. Additionally, there is evidence that susceptibility to infection in young children is quite lower compared to older age groups ([2], as

well as Tables 4 and 5 in [15]), and those children are unlikely to play a significant role in the progression of the epidemic.

We calculated the proportion of cases in each age group during the early period. Then, we calculated the corresponding proportions per age group for the later period and estimated a relative risk statistic for cases being in the later relative to the early period. Specifically, for each age group g, let $E(g)$ be the number of hospitalization with confirmed SARS-CoV-2 infection in age group g during the earlier period, and $L(g)$ be the corresponding number during the later period. The relative risk (RR) statistic is

$$RR(g) = \frac{L(g)}{\sum_h L(h)} \Big/ \frac{E(g)}{\sum_h E(h)} \qquad (1)$$

The logarithm $\ln(RR(g))$ of the RR(g) is approximately normally distributed [16] with the standard error:

$$SE = \sqrt{\frac{1}{L(g)} + \frac{1}{E(g)} - \frac{1}{\sum_h L(h)} - \frac{1}{\sum_h E(h)}} \qquad (2)$$

For each pair of age groups, the proportion ratios for those age groups are compared using the odds ratio statistic described in the Supporting Information.

Results

Table 1 shows the number of hospitalizations with confirmed SARS-CoV-2 infection in the different age groups (10-14 through 55-59 years) for the early period (April 20-May 3) and the late period (May 11-24), as well as the corresponding estimates of the RR statistic (eqs. 1,2). The highest RR estimates belong to persons aged 15-19 years (RR=1.93 (95% CI (1.19,3.12)) and 20-24 years (RR=1.40(1.07,1.83)). The RR estimates in persons aged over 30 years were significantly lower compared to persons aged 15-24 years (Supporting Information).

Table 1. Number of SARS-CoV-2 hospitalizations in different age groups during different time periods, and the estimates of the RR statistic.

Age Group, years	Early period (April 20–May 3)	Late period (May 11-24)	RR (95% CI)
10–14	17	23	1.03 (0.55,1.93)
15–19	23	58	1.93 (1.19,3.12)
20–24	84	154	1.40 (1.07,1.83)
25–29	248	344	1.06 (0.9,1.25)
30–34	419	544	0.99 (0.87,1.13)
35–39	568	738	0.99 (0.89,1.11)
40–44	773	1014	1 (0.91,1.1)
45–49	1068	1337	0.96 (0.88,1.04)
50-54	1155	1473	0.97 (0.9,1.05)
55-59	1162	1541	1.01 (0.94,1.09)

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Discussion

The SARS-CoV-2 epidemic in Mexico is growing as of early June, 2020, and it is unknown what age groups contribute the most to the spread of infection in the community. In this paper, we apply the previously developed methodology [9,13,14] to study the changing roles of different age groups between April 20 and May 24, 2020. We estimate that the greatest relative increase in the incidence of infection belongs to persons aged 15-24 years. We note that the largest increase in the relative role for the different age groups following the introduction of physical distancing measures during the SARS-CoV-2 epidemic in Germany also belonged to persons aged 15-24 years [9], with high rates of infection in those age groups also estimated in [6-8]. Those results may help inform mitigation

efforts, including the spread of awareness targeted at older adolescents and younger adults in Mexico.

We note that the causes behind the relative increase in the incidence of SARS-CoV-2 infection in older adolescents and younger adults in Mexico are uncertain. Two potential explanations behind that increase are (i) the need for persons, in particular young informal workers to return to work due to increasing economic burden of physical distancing measures; (ii) fatigue related to adherence to the physical distancing measures, resulting in progressively lesser adherence. Other explanations, such as changing social responsibilities and increased use of public transportation may also apply, and further work is needed to understand those issues to better inform future mitigation efforts.

Another limitation of our results is related to case ascertainment, namely potential temporal changes in the relation between the incidence of SARS-CoV-2 infection and the rates of hospitalizations with confirmed SARS-CoV-2 infection in the different age groups. We restricted the analysis to hospitalized cases rather than all confirmed COVID-19 cases in the community because changes in healthcare seeking behavior (e.g for ambulatory visits), and changes in testing in the outpatient setting might affect the relation between the incidence of SARS-CoV-2 infection and the rates of detected COVID-19 cases. However, such temporal changes are much less likely for hospitalized cases, with uniform guidelines for testing hospitalized cases applied in Mexico, and low likelihood of mild cases resulting in hospitalization during certain time periods. While disproportional increases in hospitalizations in healthcare works might have taken place with the surge in cases during the more recent weeks, persons aged 15-24 years are under-represented among healthcare workers compared to older age groups of adults, so this phenomenon is likely to have biased the relative risk estimates in persons aged 15-24 years downward.

We believe that despite those limitations, our results suggest that the role of younger adults and older adolescents in propagating the SARS-CoV-2 epidemic in Mexico was growing between April 20 and May 24, 2020. Mitigation efforts aimed at those age groups, including spread of awareness may be considered to stem the increase of COVID-19 incidence in the community in Mexico.

Acknowledgement: We thank Tonatiuh Barrientos and Hector Lamadrid of the Instituto Nacional de Salud Pública and Ruy-López Ridaura of the Mexican Ministry of Health who provided feedback on the results.

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