*Coronavirus Pandemic*

# Physical distancing reduced the incidence of influenza and supports a favorable impact on SARS-CoV-2 spread in Mexico

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## Abstract
Introduction: Physical distancing preventive measures were implemented in Mexico as a response to the coronavirus disease 2019 (CoViD-19) pandemic. School closures occurred on March 16, 2020, in 10 out of 32 Mexican states, and one week later in the remaining states. Because the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the influenza virus have similar transmission mechanisms, we aimed to evaluate the impact of physical distancing on the incidence of influenza as a proxy of the impact on SARS-CoV-2 contagion.
Methodology: A national flu surveillance system was cross-sectionally analyzed and daily average percent changes (APCs) of incidence rates were calculated throught Poisson regression models.
Results: Greater decreasing trends (APCs -8.8, 95% CI: -12.5, -4.5; *vs.* -6.0, 95% CI: -9.9, -2.0; p = 0.026) were documented in the states with earlier school closures and across age groups, suggesting that earlier implementation of physical distance results in reduced SARS-CoV-2 spread.
Conclusions: Physical distancing policies decrease the incidence of influenza infections in Mexico; its favorable impact on the spread of SARS-CoV-2 is commendable.

**Key words:** CoViD-19 pandemic; influenza; SARS-CoV-2; physical distancing; Mexico.

## Introduction

After the first confirmed cases of coronavirus disease 2019 (CoViD-19) by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1] were registered in Mexico in late February 2020 [2], physical distancing preventive measures were implemented by state governments, focusing on slowing the spread of CoViD-19. Those interventions included, among others, the indefinite suspension of all academic in-person classes and activities in educational settings [3], beginning on March 16 in 10 out of 32 states (Colima, Guanajuato, Jalisco, Michoacán, Nuevo León, Tamaulipas, Tlaxcala, Sonora, Veracruz and Yucatán), and one week later in the remaining states.

Despite systematic efforts, the influenza burden in Mexico remains high [4]. The SARS-CoV-2 and the influenza virus have common mechanisms of spread, and children and teenagers play a major role in flu transmission [5,6]. We aimed to evaluate the impact of physical distancing interventions on the incidence of influenza-like illness (ILI) and severe acute respiratory infection (SARI) [7], as a proxy of the impact on SARS-CoV-2 spread.

## Methodology

We conducted a cross-sectional analysis of cases registered as ILI/SARI (October 21, 2019 - March 30, 2020) in a prospective epidemiologic surveillance system belonging to the *Instituto Mexicano del Seguro Social* (Mexican Institute of Social Security) (*IMSS*, the Spanish acronym), whose characteristics have been previously described [8]. An ecologic approach was used and subjects from all ages registered as ILI/SARI cases, according to the World Health Organization criteria [7], were enrolled. The *IMSS* provides healthcare services to more than one-third of the total

population of Mexico at > 1,800 medical units (three levels of care) located throughout the country [9].

The ILI/SARI diagnoses were clustered and daily-incidence rates (per one million inhabitants) were computed. Average percent changes (APCs), and 95% confidence intervals, and the date of in-person class suspension (March 16 *vs*. March 23) were used to compare trends in influenza incidence. Poisson regression models were employed. Given that publicly available and de-identified data were used, the approval of an ethics committee was waived.

## Results

Data from 58,345 cases were analyzed and the unadjusted incidence rates are presented in Figure 1. Age-adjusted rates are presented as supplementary figures (Supplementary Figure 1, younger than 5 years; Supplementary Figure 2, 5 to 14 years; Supplementary Figure 3, 15 to 29 years; Supplementary Figure 4, 30 to 49 years; Supplementary Figure 5, 50 to 64 years; Supplementary Figure 6, 65 years or above). In general, and before March 16, the states (n = 10) with earlier scholastic activity suspension had higher incidence rates and the highest rates were documented around January 21, 2020. Stratified trends were computed
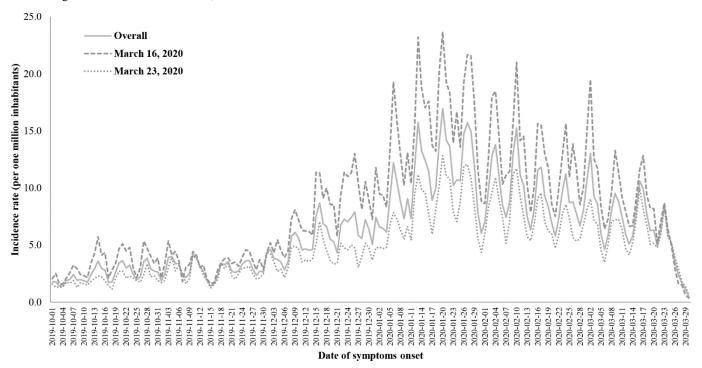
(October 1, 2019 - January 20, 2020; January 21 - March 15, 2020; March 16 - March 30, 2020) and the daily-APCs are presented in Table 1. Significant decreasing trends (APCs) were documented in the two groups of states and in most age groups since late January (school closures: March 16, -1.1, 95% CI: -1.5, -0.6; March 20, -1.0, 95% CI: -1.4, -0.6). The estimates ranged from -0.3 (95% CI: -0.9, -0.2; subjects 15-29 years of age; school closures on March 20) to -2.0 (95% CI: -2.6, -1.4; subjects 50-54 years of age; school closures on March 16).

However, the decrease was greater in the states that had an earlier preventive measure implementation date and was observed across age groups, including older adults. The overall daily APC in the first ten states to close schools, from March 16 to 30, was -8.8 (95% CI: -12.5, -4.5), which was 46.5% higher than the change observed in the rest of the states (-6.0, 95% CI: -9.9, -2.0). This difference was statiscally significant (*p* = 0.026).

## Discussion

Our findings suggest that physical distancing policies implemented in Mexico were effective in diminishing the community spread of the influenza

**Figure 1.** Unadjusted incidence rates (per one million inhabitants) of influenza virus infection at the Instituto Mexicano del Seguro Social, according to the date of school closures, Mexico 2019 – 2020.



Influenza-like illness (ILI) and severe acute respiratory infection (SARI) were clustered for the aim of the present study.
Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (SINOLAVE) of the Instituto Mexicano del Seguro Social

virus, implying their positive impact on SARS-CoV-2 spread. The potential limitations of an ecologic analysis must be considered in the interpretation of our results.

The spread of CoViD-19 in Mexico has been documented as slow, up to the end of the first trimester. By March 30 (32 days from the first registered case), only 993 confirmed cases were observed [10] (about 7.8 cases per one million inhabitants). Decreased mobility trends were documented in Mexico during the second half of March [11]. Therefore, the physical distancing policies, including the isolation of infected individuals and family members, distancing at the workplace, and school closure, most likely contributed to that favorable scenario [12]. The presented results are consistent with those recently reported in South Korea [13] and Hong-Kong [14], where non-pharmaceutical interventions focusing on the reduction of SARS-CoV-2 spread, also seemed to dimish the transmission of influenza virus.

## Conclusion

Because physical distancing policies diminished the incidence of influenza infections, their favorable impact on SARS-CoV-2 spread is plausible. Despite the fact that those policies are a challenge for health authorities and involve ethical and economic issues, their positive impact on respiratory virus spread must be considered.

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**Table 1**. Average percentage of change in overall daily influenza and age-stratified incidence rates, Mexico 2019 – 2020.

| Age group | Period, APC (95% CI) | | |
|---|---|---|---|
| | Oct. 1 - Jan. 20 | Jan. 21 - Mar. 15 | Mar. 16 - Mar. 30 |
| **All the states** | | | |
| Overall | 1.8 (1.6, 2.0) | -1.0 (-1.4, -0.6) | -7.2 (-11.1, -3.1) |
| 5/lower | 1.0 (0.8, 1.2) | -1.1 (-1.6, -0.7) | -10.0 (-13.3, -6.4) |
| 5 - 14 | 1.8 (1.5, 2.1) | -1.3 (-1.8, -0.9) | -11.7 (-15.7, -7.6) |
| 15 - 29 | 2.0 (1.8, 2.3) | -0.5(-0.9, 0.003) | -8.0 (-12.2, -3.6) |
| 30 - 49 | 2.3 (2.0, 2.5) | -1.2 (-1.7, -0.7) | -5.5 (-9.8, -1.1) |
| 50 - 64 | 1.9 (1.7, 2.1) | -1.6 (-2.1, -1.2) | -6.2 (-10.4, -1.8) |
| 65/higher | 1.1 (0.9, 1.3) | -1.0 (-1.5, -0.6) | -7.4 (-10.2, -4.4) |
| **From March 16, 2020 (10 states)[a]** | | | |
| Overall | 2.0 (1.8, 2.2) | -1.1 (-1.5, -0.6) | -8.8 (-12.5, -4.5) |
| 5/lower | 1.7 (1.5, 2.0) | -1.0 (-1.5, -0.5) | -12.0 (-15.4, -8.5) |
| 5 - 14 | 2.0 (1.7, 2.3) | -1.1 (-1.6, -0.5) | -13.7 (-18.4, -8.7) |
| 15 - 29 | 2.1 (1.8, 2.4) | -0.6 (-1.0, -0.1) | -9.2 (-13.5, -4.5) |
| 30 - 49 | 2.2 (1.9, 2.5) | -1.3 (-1.8, -0.8) | -7.1 (-11.6, -2.3) |
| 50 - 64 | 1.9 (1.7, 2.2) | -2.0 (-2.6, -1.4) | -7.4 (-11.7, -3.0) |
| 65/higher | 1.5 (1.2, 1.8) | -1.3 (-1.9, -0.6) | -9.3 (-13.2, -5.1) |
| **From March 23, 2020 (22 states)** | | | |
| Overall | 1.6 (1.4, 1.8) | -1.0 (-1.4, -0.6) | -6.0 (-9.9, -2.0) |
| 5/lower | 0.3 (0.1, 0.5) | -1.3 (-1.9, -0.8) | -7.8 (-11.7, -3.7) |
| 5 - 14 | 1.6 (1.3, 2.0) | -1.7 (-2.1, -1.2) | -9.7 (-14.0, -5.2) |
| 15 - 29 | 1.9 (1.7, 2.2) | -0.3 (-0.9, -0.2) | -7.0 (-11.2, -2.7) |
| 30 - 49 | 2.3 (2.1, 2.5) | -1.1 (-1.6, -0.6) | -4.6 (-8.7, -0.2) |
| 50 - 64 | 1.8 (1.6, 2.0) | -1.3 (-1.8, -0.8) | -5.4 (-9.9, -0.6) |
| 65/higher | 0.8 (0.6, 1.1) | -0.9 (-1.4, -0.3) | -6.3 (-9.3, -3.2) |

APC: average percent change (computed through Poisson regression models); CI: confidence interval. Daily incidence rates of influenza-like illness per million inhabitants were computed, according to the date of symptom onset. [a] 10 out of 32 Mexican States suspended in-person academic classes starting from March 16, 2020: Colima, Guanajuato, Jalisco, Michoacán, Nuevo León, Tamaulipas, Tlaxcala, Sonora, Veracruz, and Yucatán. Source: the Online Notification System for the Epidemiologic Surveillance of Influenza; *SINOLAVE*, the Spanish acronym) belonging to the *Instituto Mexicano del Seguro Social*.

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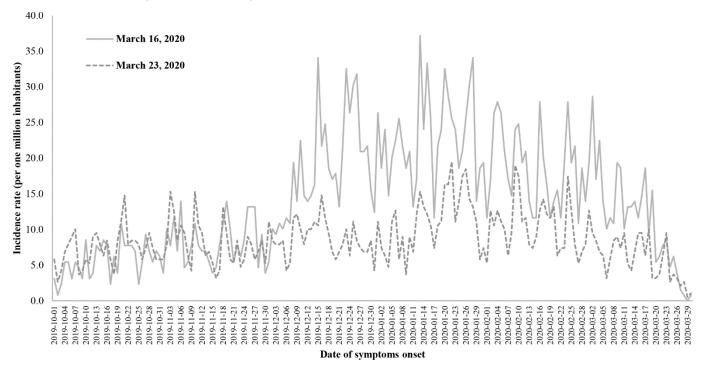
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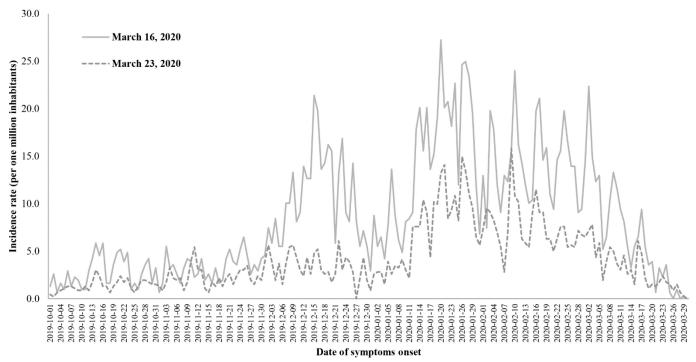**Conflict of interests:** No conflict of interests is declared.

## Annex – Supplementary Items

**Supplementary Figure 1.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects under 5 years old, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019-2020.
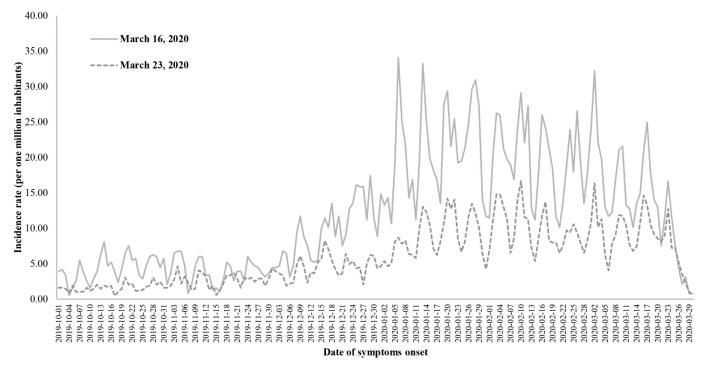


Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*

**Supplementary Figure 2.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects aged 5-14 years old, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019 – 2020.
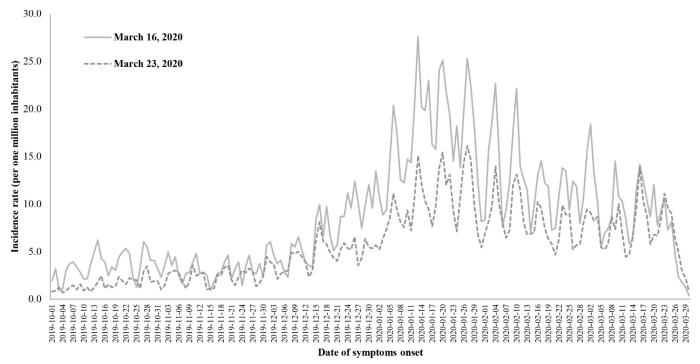


Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*

**Supplementary Figure 3.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects aged 15-29 years old, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019 – 2020.
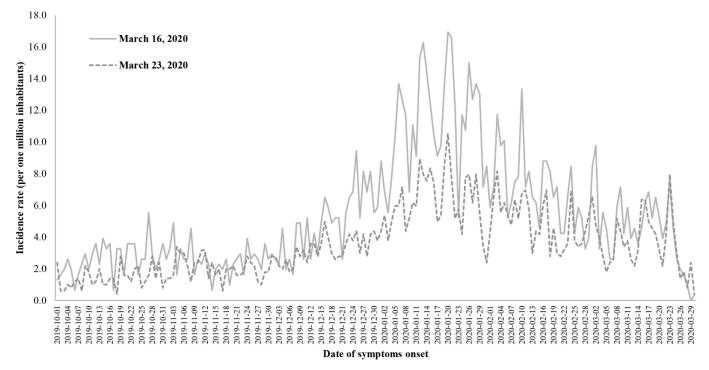


Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*

**Supplementary Figure 4.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects aged 30-49 years old, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019 – 2020.
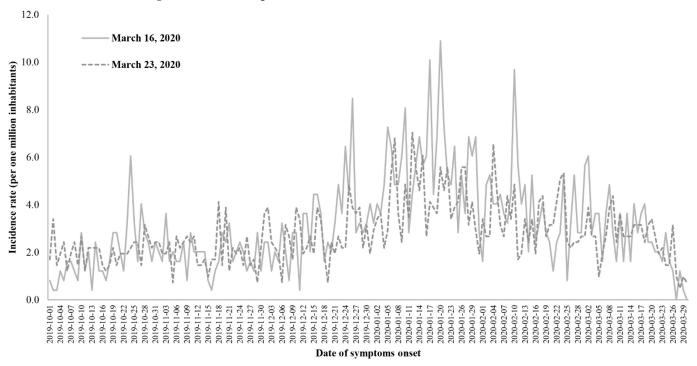


Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*

**Supplementary Figure 5.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects aged 50-64 years old, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019 – 2020.



Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*

**Supplementary Figure 6.** Incidence rates (per one million inhabitants) of influenza virus infection in subjects aged 65 years and older, at the *Instituto Mexicano del Seguro Social*, according to the date of school closures, Mexico 2019 – 2020.



Source: Self-elaborated by authors by using data from the Online Notification System for the Epidemiologic Surveillance of Influenza (*SINOLAVE*) of the *Instituto Mexicano del Seguro Social*