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Short Communication

Changing influenza activity in the Southern hemisphere countries during the COVID-19 pandemic



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ABSTRACT

Introduction: While the reduction in influenza cases in the Northern hemisphere in 2020 has been widely reported, the influenza transmission dynamics in the Southern hemisphere remain uncharacterized.

Methods: This study analysed the change in influenza-positive proportion (IPP) between 2010–2019 and 2020 in countries in the Southern hemisphere with $\leq 40\%$ missing IPP data in FluNet to assess how coronavirus disease 2019 (COVID-19) relates to influenza activity. The analysis considered the incidence of COVID-19 reported by the World Health Organization and the implementation date of non-pharmaceutical interventions (NPIs) reported by the Oxford COVID-19 Government Response Tracker.

Results: In each of the seven included countries, the average IPP was lower in 2020 than in 2010–2019 ($P < 0.01$), with the largest difference being 31.1% (95% confidence interval 28.4–33.7%). In Argentina, Bolivia, Chile and South Africa, higher IPPs were observed during epidemiological weeks 4–16 in 2020 compared with the same weeks in 2010–2019. The IPP increased after NPIs were implemented in Argentina and South Africa, but started to decline in Bolivia, Chile, Madagascar and Paraguay before NPI implementation.

Conclusions: Influenza burden and activity decreased in 2020 in the Southern hemisphere. The temporal decline in influenza activity varied between countries.

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Introduction

The decrease in influenza activity in the Northern hemisphere in 2020 has been widely reported (Itaya et al., 2020; World Health Organization, 2021). However, previous studies analysing influenza activity in 2020 in the Southern hemisphere have several limitations, such as not comparing influenza transmission dynamics in 2020 with those of previous years (Olsen et al., 2020), not including all the weeks of the study year (Olsen et al., 2020; Sullivan et al., 2020), and focusing on single countries (Sullivan et al., 2020). As such, this study analysed influenza activity in 2020 and compared it with influenza activity of previous years, and investigated whether coronavirus disease 2019 (COVID-19) and the implementation of COVID-19 non-pharmaceutical

interventions (NPIs) were associated with influenza activity in the Southern hemisphere.

Methods

Country-level influenza surveillance records from 2010 to 2020, epidemiological (EPI) weeks 1–53, were extracted from the FluNet database on 4 February 2021 (World Health Organization, 2021). The influenza-positive proportion (IPP) was determined by dividing the total number of influenza-virus-positive specimens, including influenza A and B, by the total number of specimens. Among the countries below the Equator, those with $\leq 40\%$ missing IPP data for 2020 were included.

Daily data on new confirmed cases of COVID-19 from 1 January 2020 to 2 January 2021 were collected from the World Health Organization (WHO) database (World Health Organization, 2020). The incidence of COVID-19 was defined as the number of confirmed cases per million persons. Using the Oxford COVID-19 Government Response Tracker database (Hale et al., 2020), the implementation date of the first COVID-19 NPI, referred to by WHO

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Table 1

Weekly influenza-positive proportion (IPP) and number of weeks with IPP $\geq 10\%$ in 2010–2019 and after the coronavirus disease 2019 outbreak (2020) in countries of the Southern hemisphere.

Country	IPP (%)				Number of weeks with IPP $\geq 10\%$ per year				
	Mean (SD) 2010–2019	Mean (SD) 2020	Median difference (95% CI)	P-value*	2010–2019				2020
					Min	Med	Mean	Max	
Argentina ^a	3.8 (2.4)	1.1 (1.7)	3.1 (2.0–4.3)	<0.01	0.0	6.5	5.4	10.0	0
Australia ^b	11.6 (5.5)	1.1 (2.3)	9.8 (7.5–12.4)	<0.01	16.0	21.0	24.8	35.0	0
Bolivia ^a	16.7 (5.2)	5.3 (11.0)	15.6 (11.3–17.3)	<0.01	18.0	31.5	31.1	39.0	9
Chile ^a	4.8 (3.0)	0.8 (1.5)	4.0 (2.8–5.3)	<0.01	0.0	6.5	7.1	17.0	0
Madagascar ^a	34.3 (8.4)	6.1 (20.4)	31.1 (28.4–33.7)	<0.01	34.0	41.5	41.3	49.0	6
Paraguay ^a	10.1 (5.8)	1.1 (2.3)	8.6 (6.6–10.5)	<0.01	10.0	15.5	16.9	28.0	1
South Africa ^c	10.7 (10.6)	2.5 (5.1)	8.9 (4.0–12.7)	<0.01	16.0	19.5	19.8	24.0	8

SD, standard deviation; CI, confidence interval; Min, minimum, Med, median; Max, maximum.

^a Subject-year: 2010–2020.

^b Subject-year: 2015–2020.

^c Subject-year: 2016–2020.

* P-value of the Wilcoxon signed-rank test.

as NPIs for influenza A and B (World Health Organization, 2019), in each country was extracted. All data used in this study were publicly available.

Wilcoxon signed-rank tests were used to compare the average IPP before and after 2020, and R Version 4.0.2 (R Foundation for Statistical Computing, <https://www.r-project.org>) was used for statistical analysis. Significance was set at $P < 0.05$.

Results

Among the 22 countries that lie entirely below the Equator, Argentina, Australia, Bolivia, Chile, Madagascar, Paraguay and South Africa were included in this study (Figure S1, see online Supplementary material). The average IPPs decreased significantly in 2020 compared with the preceding 10 years ($P < 0.01$) (Table 1).

Madagascar displayed the most significant difference in average IPP [31.1%, 95% confidence interval (CI) 28.4–33.7%]. All included countries had $<10\%$ IPP in 2020. Argentina, Australia and Chile had no weeks with an IPP $\geq 10\%$ in 2020, and Bolivia had the most weeks ($n = 9$) with an IPP $\geq 10\%$ in 2020 (Table 1).

None of the countries showed an increase during the 2020 influenza season (Figure 1). In Argentina (Figure 1A), Bolivia (Figure 1C), Chile (Figure 1D) and South Africa (Figure 1G), higher IPPs were observed at the beginning of the year (EPI weeks 4–16) compared with the corresponding period of previous years. However, the peak only lasted for approximately 12 weeks.

After the implementation of NPIs, the IPP of Australia (Figure 1B) decreased immediately, while the IPPs of Argentina (Figure 1A) and South Africa (Figure 1G) increased. The IPP started to decline before NPI implementation in Bolivia (Figure 1C), Chile

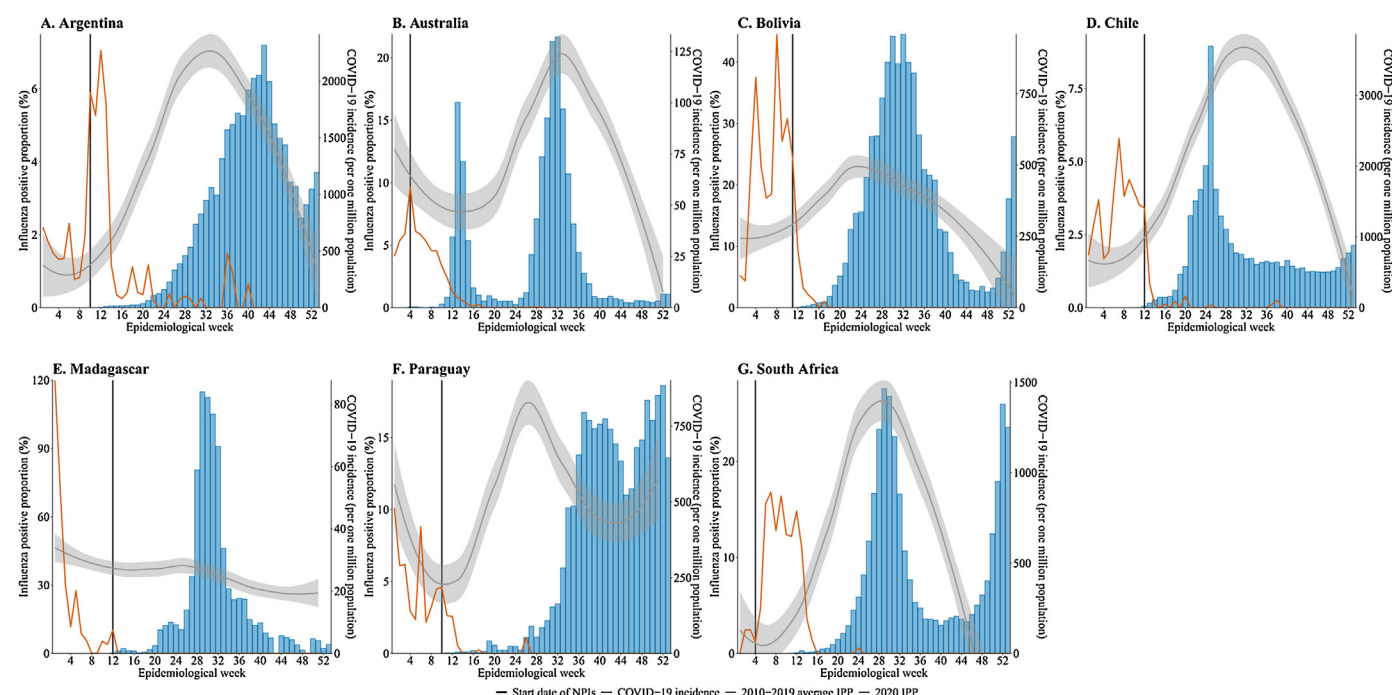


Figure 1. Trends in influenza-positive proportion (IPP) (%) and the incidence of coronavirus disease 2019 (COVID-19) in seven countries in the Southern hemisphere. The panels represent Argentina (A), Australia (B), Bolivia (C), Chile (D), Madagascar (E), Paraguay (F) and South Africa (G). The y-axis on the left represents IPP (%) and that on the right represents the incidence of COVID-19 per million persons. The x-axis indicates the epidemiological weeks. The red lines represent IPP (%) in 2020. The grey line in Panel B (Australia) represents the average IPP from 2015 to 2019, and the grey bands represent the 95% confidence interval (CI). The grey line in Panel G (South Africa) represents the average IPP from 2010 to 2019, and the grey bands represent the 95% CI. The black lines represent the start date of non-pharmaceutical interventions (NPIs). The blue bars represent the incidence of COVID-19.

(Figure 1D), Madagascar (Figure 1E) and Paraguay (Figure 1F). However, none of the countries registered influenza surges after the incidence of COVID-19 increased.

Discussion

The IPPs in the Southern hemisphere were significantly lower, and seasonal peaks were not observed in 2020 compared with 2010–2019. Interestingly, the mean number of specimens tested for influenza was higher in Australia and Paraguay in 2020 than in previous years (Table S1, see online Supplementary material).

Decreased influenza activity cannot be solely explained by NPIs as IPP increased after NPI implementation in some countries, and decreased before NPIs were initiated in other countries. The natural end of the influenza season could partially explain the lower IPP, considering that the 2020 influenza peaks in Argentina, Bolivia, Chile and South Africa started on EPI week 4 and only lasted for 12 weeks. Additionally, climatic effects (Martins et al., 2020), viral interference (Patwardhan and Ohler, 2021), and limited surveillance capabilities to accurately monitor various viral diseases simultaneously (Chotpitayasunondh et al., 2020) could be other contributing factors.

Being an ecological study, the present study does not demonstrate causality. However, the authors analysed whether NPI implementation could explain the decrease in IPP by comparing the timelines of the events. Differences in NPI stringency and public compliance with NPIs were not explored in this study because data were unavailable. As FluNet data could be incomplete as this database comprises voluntarily shared records, countries with >40% missing data were excluded from this study.

Conclusions

Countries in the Southern hemisphere showed unusual seasonal influenza transmission patterns in 2020, although peaks were observed at the beginning of the year in some countries. The temporal declines in influenza activity varied between countries.

Conflict of interest

None declared.

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None.

Ethical approval

The Institutional Review Board (IRB) of Korea University granted exemption for this study (IRB exemption number: KUIRB-2021-0034-01).

Authors' contributions

Jeehyun Kim, Raquel Elizabeth Gómez Gómez, Kwan Hong and Byung Chul Chun designed the study. Jeehyun Kim, Raquel Elizabeth Gómez Gómez and Sujin Yum acquired the data. Jeehyun Kim and Raquel Elizabeth Gómez Gómez analysed the data. Jeehyun Kim and Raquel Elizabeth Gómez Gómez wrote the first draft of the manuscript. Jeehyun Kim, Raquel Elizabeth Gómez Gómez, Jieun Jang and Byung Chul Chun revised the manuscript. All authors contributed to the discussion, reviewed and approved the final version of the manuscript.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ijid.2021.05.039>.

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