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LETTER TO THE EDITOR

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Dual impacts of the COVID-19 nonpharmaceutical interventions on other infectious diseases

Dear Editor,

Various analyses showed that COVID-19 nonpharmaceutical interventions (NPIs), such as lockdown of cities, restriction of traveling and gathering, social distancing, mass mask-wearing, and mass disinfection implemented in many countries, reduced the incidences of multiple infectious diseases transmitted through the oral or nasal routes.[1–8] Here, we explain and validate that these NPIs could also enhance the incidences of multiple other infectious diseases that mainly attack the bottom people using the statistics of 36 infectious diseases in China in 2020 and 2021 (Figure 1). The dual impacts of COVID-19 NPIs are important to evaluate correctly the benefits and the costs of COVID-19 NPIs. They suggest that the bottom people need to be aided to prevent multiple infectious diseases during the fight against pandemics.[9]

Annual counts of new cases of all infectious diseases notifiable in China and the population data were collected from the official websites (Supporting Information S1) (http://www.nhc.gov.cn/jkj/s3578/new_list.shtml; http://www.stats.gov.cn/tjsj/tjgb/ndtjgb/). Ten of these diseases were excluded because they were not notifiable in all the years 2011–2019, or most of their annual cases were <10. The incidences of the remaining 36 diseases were further analyzed.

The relative incidence (RI) was calculated by dividing the annual incidence of a disease by the average incidence of the disease in the years 2011–2019. The changes in the RI and the incidence were fully consistent with each other, and the RI is easier than the incidence to be compared among different diseases (Figure 2).

The increasing or declining tendencies of diseases before the pandemic were calculated using the Mann-Kendall test. The first-order difference (FoD) in the RI was employed to exclude the confounding effect of the significant increasing or declining tendencies on the impacts of COVID-19 NPIs (Supporting Information S1). $p < 0.05$ represented statistical significance throughout.

From 2011 to 2019, the RI increased significantly in 9 diseases (Figure 2A–I), declined significantly in 14 diseases (Figure 2J–W), and changed not significantly in 13 diseases (Figure 2X–AI), as per the Mann-Kendall test.

In 2020, the RIs of all the 36 diseases except leptospirosis, leishmaniasis, and brucellosis declined, as compared with 2019, and the RIs of 11 diseases, namely, acquired immunodeficiency syndrome (AIDS), influenza, hepatitis C, pertussis, scarlet fever, syphilis, other infectious diarrhea (namely, infectious diarrhea excluding other diseases presented in this analysis), pulmonary tuberculosis, hand-foot-mouth disease, hepatitis E, and acute hemorrhagic conjunctivitis declined significantly as compared with the relevant averages of the years 2011–2019 (Figure 2). In 2021, although the RIs of no diseases further declined significantly, the RIs of the above 11 diseases except other infectious diarrhea remained significantly lower than the relevant averages for the years 2011–2019 (Figure 2). Of the above 11 diseases, 8 were transmitted through oral or nasal routes, which matches the opinion that COVID-19 NPIs could reduce the RIs of this type of infectious disease and is consistent with previous analyses.[2–8] The RIs of the three sexually transmitted diseases (AIDS, hepatitis C, and syphilis) declined significantly possibly because COVID-19 NPIs reduced significantly unsafe sexual behaviors.

In 2021, the RIs of half of the 36 diseases increased as compared with 2020, and the RIs of hepatitis E, brucellosis, typhus, and anthrax increased or rebounded significantly as per their RIs or FoDs as compared with the relevant averages of the years 2011–2019 (Figure 2). All these four diseases mainly attack the bottom people. This supports our novel opinion that the RIs of some infectious diseases could increase due to reduced personal and public health investment in the control of these infectious diseases caused by COVID-19 NPIs, as COVID-19 NPIs reduced greatly the incomes of many bottom people and occupied too much public health resources (Figure 1).[9]

To our knowledge, this analysis is unique in having all the following advantages: it presented and validated a novel hypothesis that COVID-19 NPIs could have the dual effects on other infectious

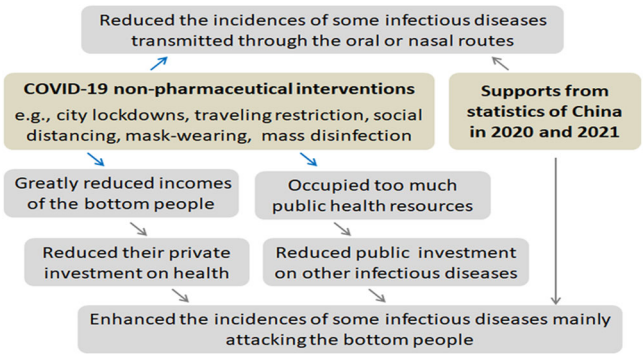

FIGURE 1 Integration of three previous opinions shown by blue arrows into our statistics-supported opinion.

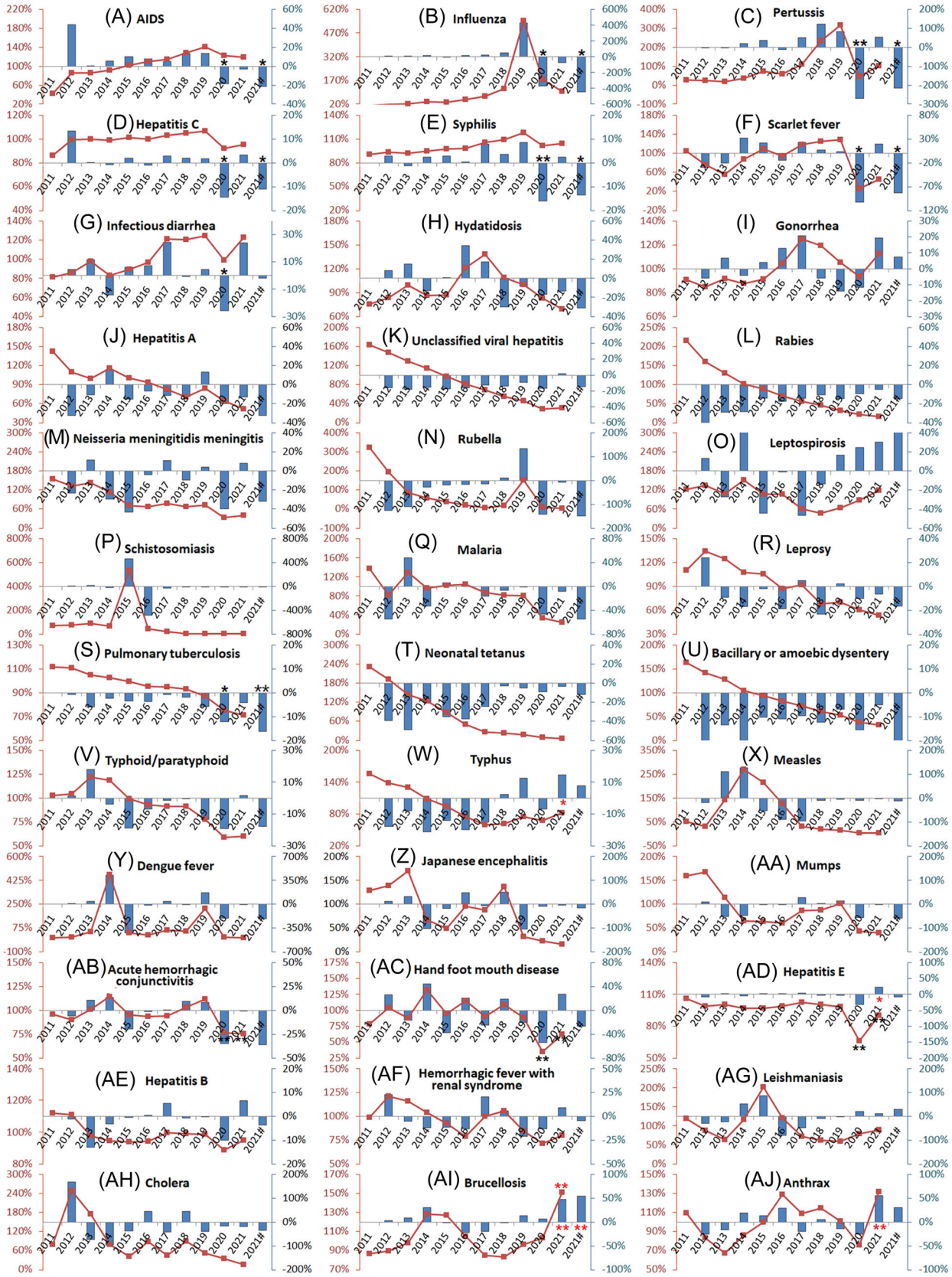

FIGURE 2 Changes in the relative incidences (RIs) in red lines and their first-order differences (FoDs) in blue bars of 36 infectious diseases in China in 2011–2021. *$p < 0.05$, **$p < 0.01$, red asterisks significant increase compared with the years 2011–2019, and black asterisks significant decline compared with the years 2011–2019. The asterisks near the abscissa are for the blue bars, and the asterisks near the red squares are for the red squares.

diseases; it excluded statistically the confounding effect of the increasing or declining tendencies in the incidences before the pandemic; it analyzed the impacts of COVID-19 NPIs on other infectious diseases in 2021; its analyzed the impacts of COVID-19 NPIs on over 35 infectious diseases.

AUTHOR CONTRIBUTIONS

Ji-Ming Chen and Yi-Qing Chen conceived this study, collected the data, conducted data analysis, and drafted the manuscript. Yi-Qing Chen optimized the statistical methods. Yu-Fei Ji participated in data collection and analysis. Ji-Ming Chen supported this study and revised the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data supporting the views of this analysis are available from the corresponding author on request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.