

Trend of gastrointestinal infections following nonpharmaceutical interventions, South Korea, 2020

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To the Editor

The recent article by Kraay et al [1] described the impact of non-pharmaceutical intervention (NPI) for SARS-CoV-2 on norovirus outbreaks in 9 US states. Various NPIs have been implemented globally during 2020 to curtail the coronavirus disease 2019 (COVID-19) pandemic [2]. Multiple observational studies have found that NPI have shown a beneficial effect in reducing SARS-CoV-2 and other respiratory virus infections [3]. Yet, descriptions of the impact of NPI on gastrointestinal infections are limited [4-6]. We wish to report our experience in South Korea showing a correlation between the introduction of NPI and reduction in the infection rates of gastrointestinal pathogens

In South Korea, strict NPI including social distancing, personal hygiene including hand washing, wearing facial masks and disinfecting high-touch surfaces have been implemented since March 2020 [7]. We analyzed data from the national surveillance system that collects weekly reports from 196 sentinel centers across the country [8]. The sentinel centers submitted data on laboratory-confirmed cases (either through isolation of pathogens or detection by toxin assay, antigen assay, and/or PCR tests) for viral, bacterial, and protozoan pathogens. We selected norovirus, rotavirus, *Campylobacter* spp., *Clostridium perfringens*, and, *Salmonella* spp., for analyses.

The monthly variations in incidence of norovirus, rotavirus, *Campylobacter* spp., *Clostridium perfringens*, and *Salmonella* spp. in 2015-2019 vs. 2020 are graphically represented in **Figure 1** in order to illustrate how sequential modifications in the intensity of NPI starting in March 2020 impacted the detection of enteric pathogens. The NPI consisted of four levels of social distancing (SD) campaigns, SD intensification, and distancing in daily life (loosened SD) [7]. Activity of norovirus and rotavirus increased from approximately the 45th week to the 20th week of the following year in 2015-2019, whereas their activity in

2020 was lower during these weeks. Reported frequencies of *Campylobacter* spp. and *Salmonella* spp. in 2020 was similar to that of 2015-2019 with peaks from approximately the 20th to 40th week and 20th to 45th week, respectively. *C. perfringens* had similar activities in 2020 compared to that of 2015-2019. Among gastrointestinal viral pathogens, the percentage change in reported cases in 2020 relative to the average number of cases in 2015-2019 declined for rotavirus (-60.8%) and norovirus cases (-20.5%). On the other hand, there were significant increases in reported cases of *Campylobacter* spp. (+84.4%) and *C. perfringens* (+60.4%) in 2020 relative to 2015-2019, whereas the change in rates of *Salmonella* spp. (+3.8%) was small between the two time periods.

In summary, we observed substantial declines in the activity of viral enteric pathogens (rotavirus and norovirus, albeit to a smaller extent), following implementation of NPI in 2020. On the other hand, rates of *Campylobacter* spp., *C. perfringens*, and *Salmonella* spp. were either similar or higher in 2020 compared with the previous five years. The reasons for higher frequencies of certain bacteria are not known but the common feature of these microbes is that they are all foodborne pathogens, which may indicate a possible mode of transmission. Alongside a decrease in eating out and more handwashing in 2020, our findings suggest differential public health impact of social distancing on food and waterborne infectious disease epidemiology. Our findings are in accord with other investigations on the favorable impact of NPI on nonpolio enterovirus [9], norovirus [1], rotavirus and shigellosis [6]. Together, these findings suggest that nationwide nonpharmaceutical public health interventions are highly effective in interrupting person-to-person transmission of gastrointestinal pathogens.

Our study is limited by presumed incomplete reporting of enteric pathogens due to restricted healthcare access caused by the COVID-19 pandemic, and differences in clinical practice leading to variations in testing for enteric pathogens. Despite these limitations, these

data provide informative estimates of the impact of NPI on transmission of gastrointestinal pathogens at a national level. Our findings indicate that NPI have the greatest impact on pathogens that are transmitted persons-to-person, whereas the effect was smaller for foodborne bacteria.

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Author contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Sangshin Park, Ian Michelow, and Young June Choe. The first draft of the manuscript was written by Sangshin Park and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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None exist.

Ethical statement

Aggregated de-identifiable data from publicly available source was used and was exempted from the IRB review.

Reference

1. Kraay ANM, Han P, Kambhampati AK, Wikswo ME, Mirza SA, Lopman BA. Impact of non-pharmaceutical interventions (NPIs) for SARS-CoV-2 on norovirus outbreaks: an analysis of outbreaks reported by 9 US States. *The Journal of infectious diseases* **2021**.
2. Bo Y, Guo C, Lin C, et al. Effectiveness of non-pharmaceutical interventions on COVID-19 transmission in 190 countries from 23 January to 13 April 2020. *Int J Infect Dis* **2021**; 102: 247-53.
3. Baker RE, Park SW, Yang W, Vecchi GA, Metcalf CJE, Grenfell BT. The impact of COVID-19 nonpharmaceutical interventions on the future dynamics of endemic infections. *Proc Natl Acad Sci U S A* **2020**; 117(48): 30547-53.
4. Angoulvant F, Ouldali N, Yang DD, et al. COVID-19 pandemic: Impact caused by school closure and national lockdown on pediatric visits and admissions for viral and non-viral infections, a time series analysis. *Clin Infect Dis* **2020**.
5. Hatoun J, Correa ET, Donahue SMA, Vernacchio L. Social Distancing for COVID-19 and Diagnoses of Other Infectious Diseases in Children. *Pediatrics* **2020**; 146(4).
6. Xie O, Markey PG, Draper ADK, Krause VL. Physical distancing and non-respiratory notifiable diseases in the Northern Territory, March-May 2020. *Commun Dis Intell (2018)* **2020**; 44.

7. Min KD, Kang H, Lee JY, Jeon S, Cho SI. Estimating the Effectiveness of Non-Pharmaceutical Interventions on COVID-19 Control in Korea. *J Korean Med Sci* **2020**; 35(35): e321.
8. Korea Disease Control and Prevention Agency. Infectious Disease Portal. Accessed at: <http://www.kdca.go.kr/npt/>; Accessed on: December 5, 2020.
9. Kuo SC, Tsou HH, Wu HY, et al. Nonpolio Enterovirus Activity during the COVID-19 Pandemic, Taiwan, 2020. *Emerg Infect Dis* **2021**; 27(1): 306-8.

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Figure Legend

Figure 1. Impact of nonpharmaceutical intervention on incidences of (A) norovirus, (B) rotavirus, (C) *Campylobacter* spp., (D) *Clostridium perfringens*, and (E) *Salmonella* spp., national surveillance for gastrointestinal pathogens, South Korea, 2015-2019 vs. 2020.

* Abbreviation: SD, social distancing

** Social distancing measures were phased based on the reported number of COVID-19 cases nationally (from low to high; distancing in daily life, levels 1-3 with intensification in between)

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Figure 1

