

1 **A Retrospective Database Analysis of Before and After Social Distancing in Relation to**
2 **Pediatric Infection Rate and Healthcare Services Usage During the COVID-19 Pandemic**

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4 Ran Levy, MD¹, Regev Cohen, MD^{2,3,4}, Liat Lev-Shalem, PhD⁵, Arik Eisenkraft, MD⁶†, Tehila
5 Fisher Yosef, MD¹

6

7 ¹Maccabi Healthcare Services, Israel; ²Ruth and Bruce Rappaport Faculty of Medicine, Technion
8 University, Haifa, Israel; ³Infectious Diseases Unit, Laniado Medical Center, Netanya, Israel;
9 ⁴Infectious Diseases Unit, Hillel-Yaffe Medical Center, Hadera, Israel; ⁵Maccabitech Institute of
10 Research and Innovation, Maccabi Healthcare Services, Israel; ⁶The Institute for Research in
11 Military Medicine, The Hebrew University Faculty of Medicine and the IDF Medical Corps,
12 Jerusalem, Israel.

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14 †Corresponding Author: Prof. Arik Eisenkraft, MD, MHA; Institute for Research in Military
15 Medicine, Faculty of Medicine, The Hebrew University of Jerusalem and the IDF Medical
16 Corps, POB 12272, Jerusalem 91120, Israel. Tel: +972-52-9210896, +972-2-6757657, Fax:
17 +972-2-6757660, email: aizenkra@gmail.com.

18

19 Running title: COVID Social Distance and Infection Rate.

20

1 **Abstract**

2 **Background**

3 Social distancing policy was introduced in Israel in 2020 to reduce the spread of
4 COVID-19. The aim of this study was to analyze the effect of social distancing on other
5 infections in children, by comparing disease rate and healthcare utilization before and
6 after social distancing.

7 **Methods**

8 This was a before-and-after study. Within this retrospective database analysis of
9 parallel periods in 2019 (Period 1 and 2) and 2020 (period 3 - pre-lockdown period,
10 and Period 4 - lockdown period) we included all pediatric population registered in the
11 electronic medical records of the Maccabi Healthcare Services, Israel, looking at the
12 occurrence of non-COVID infections, antibiotic purchasing, doctor visits, Ambulatory
13 Emergency Care Centers visits, Emergency Departments' visits, and hospitalizations.

14 **Results**

15 776,828 and 777,729 children from 2019 and 2020, respectively, were included. We
16 found a lower infection rate in 2020 vs 2019. We did not find a difference in infection
17 rate between Periods 1-2, while a significant difference was found between Periods 3-
18 4. We found a significant difference between Periods 2-4, with a higher RR than in
19 Periods 1-3. A modest decrease in Ambulatory Emergency Care Center visits, and
20 lower increase in emergency department visits and hospital admissions was found in
21 2020.

22 We found decreases in antibiotic purchasing between Periods 1-3 and Periods 2-4,
23 more pronounced in 2020 than in 2019.

24 **Conclusions and Relevance:**

25 Analysis of before and after social distancing and masking showed reduced prevalence
26 of non-COVID pediatric infections, consumption of health care services, and antibiotics
27 consumption.

28

29 **Keywords:** COVID-19; social distancing; infection rates; big data analysis; pediatrics

30

1 **Introduction**

2 Following the spread of the COVID-19 pandemic in Israel, a national social distancing policy
3 including lockdown was adopted as part of efforts to control the spread of the first wave of the
4 disease. This policy included the closing of schools, kindergartens, nurseries, informal youth
5 organizations, and most working places unless defined as crucial to battle the pandemic and
6 sustain the economy, lasting between 03/17/2020-04/19/2020. Simultaneously, telemedicine
7 solutions were rapidly implemented, like in other countries [1-5]. Extensive guidance was given
8 through traditional and social media platforms regarding distancing, hand washing, and using
9 facemasks; and severe constraints were imposed on transportation and ambulation. People were
10 not allowed to host anyone outside of their nuclear family, and distance confinement was limited
11 to 100 meters from residence [6]. Several studies were conducted to test whether implementing
12 these measures helped in reducing the COVID-19 transmission. A European study compared the
13 transmission and COVID-19 incidence curves in Europe using the data of the European Centre
14 for Disease Prevention and Control, correlating it with the level of mobility, presence, and
15 crowdedness of the population in public spaces based on cellular communication and GPS data
16 [7]. The researchers found that social distancing directly and strongly delayed the viral spread.
17 Another study analyzed the effects of the general lockdown in 12 countries on the community
18 spread and mortality and found that general lockdown was associated with a significant decrease
19 in both [8]. Recently, a drastic decrease of registries for most infections was found, suggesting
20 effects of non-pharmaceutical interventions, such as social distancing, on overall disease
21 transmission [9]. While these studies focused on SARS-COV-2, studies, investigating effects of
22 social distancing on the potential decrease in the occurrence of other infectious diseases are
23 scarce, and usually focused on respiratory infections and did not cover all non-COVID

1 infections. For instance, Noh et al. have shown that during the COVID-19 pandemic and social
2 distancing imposed in South Korea, the infection rate of influenza has decreased compared to
3 previous years [10]. Other studies conducted before the pandemic have shown that social
4 distancing and school closing are effective measures in reducing rates of influenza [11-13]. To
5 date, there are only few publications from Israel on the impact of social distancing during the
6 COVID-19 pandemic on the general morbidity caused by infections in the country [14].
7 Previously, it was shown that closing schools during the winter due to strikes led to a significant
8 decrease in rates of upper respiratory tract diseases among school children [15].
9 In Israel, all residents are entitled to basic health care as a fundamental right, health care
10 is universal, and participation in a medical insurance plan is compulsory. As such, it can serve as
11 an important source of data in testing the impact of social distancing.
12 This study compares the occurrence of non-COVID infections among the pediatric population
13 registered in the Maccabi Healthcare Services (MHS) before and after the implementation of the
14 COVID-19 social distancing policy, and with the occurrence in the preceding year.

16 **Methods**

17 *Study Design*

18 The study is a before and after retrospective database analysis of a cohort of pediatric patients at
19 MHS. The total MHS database includes data on 2 million members and represents a sample
20 comprising 25% of the Israeli population. The study population is composed of all children who
21 were up to eighteen years of age at each of the two research periods in 2019 and 2020. The
22 lockdown period in Israel started on March 17th, 2020, and ended on April 19th, 2020. For the
23 data analysis, we defined the pre-lockdown period as the time between January 1st-March 22nd,

1 2020, regarded as part of the winter season in Israel, and assuming that the effect of the
2 lockdown on infections will be apparent a week after its initiation. Lockdown as well as the
3 immediate post-lockdown period was defined as the time between March 23rd-July 31st, 2020,
4 regarded as the spring/early summer seasons in Israel. Equivalent periods in 2019 were
5 compared. We named the periods Period 1 (January 1st-March 22nd, 2019), Period 2 (March 23rd-
6 July 31st, 2019), Period 3 (January 1st-March 22nd, 2020), and Period 4 (March 23rd-July 31st,
7 2020). Also, beyond comparing the before and after periods with relation to the lockdown
8 (Periods 1-3 and 2-4), we compared the differences between Periods 1-2 and 3-4 in order to
9 analyze any potential natural seasonal influence (winter vs spring and early summer in Israel)
10 and put these differences in a better context.

11 The study was approved by the MHS ethics committee. Because there was no identification of
12 the subjects for whom data were retrieved, informed consent was waived.

13 *Data*

14 The database integrated information from the patients' electronic medical records including
15 diagnoses made by the physician, medication prescriptions and purchases, consultations,
16 hospitalizations, procedures, and sociodemographic data [16]. It was collected over two
17 consecutive years - 2020 (study group), and 2019 (control group), from doctor visits,
18 Ambulatory Emergency Care Centers, Emergency Departments and hospitalizations, and
19 socioeconomic data (SES) of the MHS. In terms of diagnosis, once COVID-19 infection was
20 ruled-out, the diagnosis of a specific non-COVID infection was based on the discretion of the
21 pediatrician based on findings during the visit, as always practiced.

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1 *Statistical Analysis*

2 Descriptive statistics were presented as n and percentages. Differences between groups were
3 tested using independent sample t-tests and Chi-Square tests, results are shown as risk ratios. P
4 values <.05 were considered statistically significant. All analyses were performed using IBM
5 SPSS v.28® (IBM, NY, US).

6

7 **Results**

8 781,939 children aged 0-18 years were included in the study group (data collected from 2020),
9 4,210 were excluded after they were found to be positive to COVID-19, with 777,729 included
10 in the final analysis. The control group included 776,828 children aged 0-18 (data collected from
11 2019) (**Table 1**). 51.2% of the participants in 2019 and 2020 were males (396,352 and 408,741,
12 respectively). It is important to state that the two groups overlapped by a large part.

13 We have analyzed the effect of social distancing and masking on infection rate beyond the
14 natural difference between the winter and the spring/early summer, by comparing between the
15 four defined Periods (**Table 2**). We found a higher infection rate in 2019 than in 2020. We did
16 not find a difference in the total number of children with an infection between Period 1 and
17 Period 2 (RR 1.00, 95% CI 0.99-1.00, $p < .001$) in 2019, while a significant difference was found
18 between Period 3 and 4 in 2020 (RR 0.62, 95% CI 0.61-0.62, $p < .001$). When stratified by age
19 groups, we found that at the age range of 0-1 year, there was a higher increase in infection rate
20 between Periods 1-2 compared with Periods 3-4 (RR 1.56, 95% CI 1.54-1.59, $p < .001$ vs RR
21 1.08, 95% CI 1.07-1.1, $p < .001$, respectively, **Supplemental Table 1**). In all other age groups, in
22 Period 2 we found fewer infections compared with Period 1, and a greater decrease between
23 Periods 3-4 ($p < .001$ in all, **Supplemental Table 1**). This was true for all infections included in

1 the dataset, with decreased infectious rates between 2019 (Periods 1-2) and 2020 (Periods 3-4)
2 for acute upper respiratory tract infection and common cold, influenza, sore throat, tonsillitis,
3 pharyngitis and nasopharyngitis, herpangina and herpetic gingivostomatitis, acute otitis media,
4 bronchiolitis, pneumonia and bronchopneumonia, gastroenteritis, diarrhea, and dysentery,
5 oxyuriasis, urinary tract infection and pyelonephritis, impetigo, conjunctivitis, hand-foot-and-
6 mouth disease, cellulitis, and fever as a general diagnosis. In all, we found $p < .001$. Due to low
7 rates of meningitis, we did not include this diagnosis in the final analysis (36 cases in 2019 and
8 20 cases in 2020).

9 Next, we analyzed the difference between Periods 1-3, and between Periods 2-4 (the lockdown
10 period) (**Table 3**). The RR between Periods 1-3 was 0.95 (95% CI 0.94-0.96, $P < .001$), while
11 between Periods 2-4 it was 0.59 (95% CI 0.58-0.59, $P < .001$). As shown in the **Supplemental**
12 **Table 2**, this pattern was present in all age groups, and in all infections included in the data set,
13 with a higher RR between Periods 2-4 than between Periods 1-3, and a $p < .001$ in all infection
14 rates between Periods 2-4.

15 When analyzing visits to the emergency department, hospital admissions, and ambulatory
16 emergency care centers in Periods 1-2 and Periods 3-4, we found a modest decrease in
17 Ambulatory Emergency Care Center visits in 2020 (RR 1.64, 95% CI 1.58-1.69, $P < .001$ versus
18 an increase in 2019 (RR 0.84, 95% CI 0.81-0.88, $P < .001$) (**Supplemental Table 3**). In both
19 years (Periods 1-2 and Periods 3-4) there was an increase in emergency department visits and
20 hospital admissions, but this was milder in 2020 (RR 1.60, 95% CI 1.57-1.63, $P < .001$ vs RR
21 1.20, 95% CI 1.17-1.22, $P < .001$ for emergency department visits, and RR 1.53, 95% CI 1.49-
22 1.58, $P < .001$ vs RR 1.11, 95% CI 1.08-1.15, $P < .001$ for hospital admissions, **Supplemental**
23 **Table 3**). When comparing Periods 2-4 to Periods 1-3 we found higher RR in admission rates to

1 the Ambulatory Emergency Care Centers (1-3 - RR 0.82, 95% CI 0.79-0.85, $P < .001$ vs 2-4 - RR
2 0.42, 95% CI 0.41-0.44, $P < .001$, respectively), and lower RR in visits to emergency departments
3 (RR 0.94, 95% CI 0.92-0.96, $P < .001$ vs RR 0.70, 95% CI 0.69-0.72, $P < .001$, respectively) and
4 hospital wards (RR 0.98, 95% CI 0.95-1.01, $P < .001$ vs RR 0.71, 95% CI 0.69-0.73, $P = \text{NS}$)
5 (**Table 4**).

6 When comparing Periods 1 and 2 we found a significant increase in antibiotic purchasing among
7 all of the pediatric population, but when comparing Periods 3 and 4 we found a significant
8 decrease (1-2 - RR 1.12, 95% CI 1.11-1.13, $P < .001$ vs 3-4 - RR 0.79, 95% CI 0.78-0.79, $p < .001$).
9 When further stratifying the pediatric population, this was true in all age groups ($p < .001$ in all,
10 (**Supplemental Table 4**). Lastly, when comparing antibiotic purchasing between Periods 1-3 and
11 Periods 2-4 we found a decrease in both comparisons, more pronounced in 2020 than in 2019 (1-
12 3 - RR 0.82, 95% CI 0.81-0.83, $p < 0.001$ vs 2-4 - RR 0.58, 95% CI 0.57-0.58, $p < 0.001$,
13 respectively) (**Table 5** and **Supplemental Table 5**).

15 Discussion

16 In this study, we analyzed data of a large pediatric population comparing non-COVID infection
17 rates, antibiotic purchasing, and doctor visits between 2019 and 2020, focusing on before and
18 after the COVID-19 lockdown and social distancing period. Importantly, this policy was a
19 dramatic step never implemented in Israel until that point. Within this population, we found a
20 significant decrease in all infections within the registry in the study group (2020) when compared
21 to the control group (2019), and in all age groups.

22 Moreover, infections that typically increase in the second period of the year showed lower rates
23 in Period 4. This included acute gastroenteritis, acute otitis media, ocular infections, tonsillitis,

1 and herpangina. When looking at hand, foot, and mouth disease, we usually see the appearance
2 of outbreaks during the spring and early summer, a pattern that was found in 2019. However, in
3 2020 we found a dramatic decrease in Period 4, further emphasizing the effect of social
4 distancing on its spread.

5 Similarly, in 2019 we see an increase in gastroenteritis cases between Periods 1-2. Yet, in 2020,
6 there were no changes in the rate of gastroenteritis between Periods 3-4. Children in childcare
7 centers tend to get more infections, and young children are the most likely to catch infections.

8 There are several reasons for the spread of infections among children in everyday life. Contact
9 transmission is the principal mode of transmission for most childhood infections, typically via
10 the hands of the infected children or caregivers [17, 18]. Fecal-oral transmission of enteric
11 pathogens or the transmission of respiratory pathogens through hands that have been
12 contaminated by the secretions of infected children is such an example. Children in group
13 settings such as schools and kindergartens encounter many other children, so they have a much
14 greater chance of getting an infection from others, while sharing toys and touching each other
15 during play. Also, many children have not yet learned how to use the toilet properly or the
16 importance of proper hand hygiene. In many places the playground and toilet infrastructure are
17 not kept properly clean, leading to contact with fomites. Another route for disease transmission is
18 through droplet contact since children do not always cover their coughs and sneezes. Adding to
19 the above is understaffing and high rates of staff turnover in many child-care centers [18].

20 Our findings could indeed represent lower rates of infection transmission during the lockdown
21 and social distancing. Still, other explanations should also be considered, including lower rates of
22 diagnosis resulting from patients not arriving at the clinics due to fear of being infected with
23 COVID-19, and physicians tending to diagnose patients using telehealth platforms, which have

1 grown substantially during the pandemic and might lead to misinterpretation in some of the
2 cases. However, we regard these as contributing factors to our findings.

3 We found a significant decrease in visits to the emergency departments, hospitalization rates, and
4 visits at the ambulatory emergency care centers during the lockdown period and after, suggesting
5 reduced numbers of severe infections. This is probably also related to the population's fear of
6 getting infected while visiting a clinic or a hospital during the pandemic. However, for the sake
7 of being cautious, and as there is still a level of uncertainty regarding this component of the
8 study, we cannot be sure there were no confounding factors not related to the lockdown.

9 We also found a significant decrease in antibiotic purchasing in the study group compared with
10 the control group and in all ages. This is in accord with the scope of decrease we found in the
11 infectious disease registry, in all ages.

12 Several studies discuss the increase in prevalence of infections following removal of the
13 lockdown [19, 20]. This phenomenon contributes to the notion that the reduction was connected
14 with the lockdown rather than with other reasons such as immunologic development of children.

15 There are several limitations to this study. A before-after study might be confounded by other
16 factors and secular trends during the lockdown period. Many viral and bacterial infections appear
17 in seasonal cycles – a phenomenon that is often not fully-explained, and sometimes there are
18 deviations in this seasonal pattern [21]. In the past year, there were several reports of a
19 significant decline in influenza cases around the world. There were also reports of other
20 infections who markedly declined during the lockdown period, and resurged, sometimes outside
21 of the normal seasonality, following the uplifting of the non-pharmacological restrictions [19]. In
22 Israel, the Israel Center for Disease Control has shown that the lockdown changed the seasonal
23 pattern of several respiratory infections and the number of infections has dramatically decreased

1 during the lockdown period, differing significantly from previous years, with data from 2010 and
2 until now [22]. Moreover, the very fact that we found a decrease in all infections in the lockdown
3 period, suggests that our findings are not accidental, as it is unlikely that a significant deviation
4 in the seasonality of multiple infections will appear simultaneously in all. The same applies to
5 the decrease in consumption of all components of healthcare services. When looking at other
6 factors, no changes were made to the vaccination policy or to the costs of treatment within the
7 MHS. As previously noted, the availability of treatment has changed in light of the lockdown.
8 Still, we looked at all of the components of medical care, including clinics, call centers, and
9 hospitals, and they all remained available to the public as they were before lockdown. However,
10 we found a decline in all, which is better-explained by reduced rate of infections than by any
11 other explanation. All of this reinforces the assessment that the reduction in non-COVID
12 infections has a direct connection with the policy of lockdown and social distancing. As this
13 study focuses on rates of infections, we have included all aspects of medical care related to that,
14 and we did not look at other non-COVID conditions. However, various studies have shown a
15 decline of about 30% in non-infectious or non-communicable diagnoses such as the diagnosis of
16 malignancy during the lockdown [23]. Though it is difficult to make an accurate separation of
17 the direct effect of the lockdown on healthcare-seeking-behavior of people, at least in relation to
18 infectious diseases of the airways, people actually did come and seek healthcare services in order
19 to rule-out or confirm a diagnosis of COVID-19, and once ruled out, the working diagnosis of
20 another viral disease has been recorded. The abnormal increase in incidence of infections with
21 the removal of the lockdown also indicates a real and non-artificial decline of infections during
22 the lockdown, especially in infections of short duration [19]. In these cases, such as RSV
23 bronchiolitis, one cannot blame the lockdown for leading to a late diagnosis. In addition, while it

1 can be argued that people in general have consumed fewer healthcare services in the community,
2 it is not expected that children with a serious infection that requires hospitalization will not be
3 hospitalized for sociological or psychological reasons. If the explanation for the change we saw
4 was sociologic (e.g., fear of getting infected with COVID-19 in the clinic) we would not see a
5 gap in children's hospitalizations due to respiratory illness. A recent study has found that during
6 the lockdown period there was a decrease not only in the diagnosis of acquired pneumonia in the
7 community but also in invasive pneumococcal disease [24]. This further strengthens our
8 observation. There are cases in which drugs were prescribed without mentioning a specific
9 infectious agent. Though this could result in a reporting bias, this has not changed in recent years
10 as this is an inherent bias in the reporting system and we do not think it influenced the results.
11 We looked at the antibiotic purchasing rate, but we do not have data on their actual consumption.
12 Several components might have influenced our results, such as purchasing yet not consuming the
13 antibiotics, lack of physicians' availability, and incomplete registries. However, these complex
14 components were always present, leading us to claim that the changes we found are related to the
15 strict social distancing imposed on all - healthcare providers as well as patients - as the single
16 most important factor that changed between the periods. This study focused on infectious
17 diseases only. It is important to conduct similar analyses of other clinical conditions, to allow a
18 better and a comprehensive understanding of the full effects of social distancing on the health of
19 children during the COVID-19 pandemic.

20 **Conclusions**

21 When analyzing the registry, non-COVID pediatric infections, antibiotic purchasing, and
22 consumption of MHS services, we found lower rates of infections during and after social
23 distancing in the first wave of COVID-19 when compared to the preceding year and in all age

1 groups. Future studies should examine the impact of reduced antibiotic consumption on
2 antibiotic resistance.

3

4 **Notes**

5 **Author contributions.** R. L. and A. E. conceived of and designed the analyses. R. L. and L. L. S.
6 collected the data. R. L., R. C., L. L. S., A.E., and T. F. Y. performed the data analyses. R. L., R.
7 C., A.E., and T. F. Y. interpreted the data results. R. L., and A. E. wrote the first draft of the
8 work. All authors revised the work critically for intellectual content, approved the final version
9 of the work to be published, and are accountable for all aspects of the work in ensuring that
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1 **References**

- 2 1. Grossman Z, Chodick G, Reingold SM, Chapnick G, Ashkenazi S. The future of
3 telemedicine visits after COVID-19: perceptions of primary care pediatricians. *Isr J Health*
4 *Policy Res* 2020; 9(1):53.
- 5 2. Lieneck C, Garvey J, Collins C, Graham D, Loving C, Pearson R. Rapid Telehealth
6 Implementation during the COVID-19 Global Pandemic: A Rapid Review. *Healthcare*
7 (Basel) 2020; 8(4):517.
- 8 3. Barkai G, Gadot M, Amir H, Menashe M, Shvimer-Rothschild L, Zimlichman E. Patient and
9 clinician experience with a rapidly implemented large-scale video consultation program
10 during COVID-19. *Int J Qual Health Care* 2021; 33(1):mzaa165.
- 11 4. Gomez T, Anaya YB, Shih KJ, Tarn DM. A Qualitative Study of Primary Care Physicians'
12 Experiences With Telemedicine During COVID-19. *J Am Board Fam Med* 2021;
13 34(Suppl):S61-S70.
- 14 5. Hasson SP, Waissengrin B, Shachar E, et al. Rapid Implementation of Telemedicine During
15 the COVID-19 Pandemic: Perspectives and Preferences of Patients with Cancer. *Oncologist*
16 2021; 26(4):e679-e685.
- 17 6. Elran-Barak R, Mozeikov M. One Month into the Reinforcement of Social Distancing due to
18 the COVID-19 Outbreak: Subjective Health, Health Behaviors, and Loneliness among
19 People with Chronic Medical Conditions. *Int J Environ Res Public Health* 2020;
20 17(15):5403.

- 1 7. Delen D, Eryarsoy E, Davazdahemami B. No Place Like Home: Cross-National Data
2 Analysis of the Efficacy of Social Distancing During the COVID-19 Pandemic. *JMIR Public*
3 *Health Surveill* 2020; 6(2):e19862.
- 4 8. Ghosal S, Bhattacharyya R, Majumder M. Impact of complete lockdown on total infection
5 and death rates: A hierarchical cluster analysis. *Diabetes Metab Syndr* 2020; 14(4):707-711.
- 6 9. Ullrich A, Schranz M, Rexroth U, et al. Impact of the COVID-19 pandemic and associated
7 non-pharmaceutical interventions on other notifiable infectious diseases in Germany: An
8 analysis of national surveillance data during week 1-2016 - week 32-2020. *Lancet Reg*
9 *Health Eur* 2021; 6:100103.
- 10 10. Noh JY, Seong H, Yoon JG, Song JY, Cheong HJ, Kim WJ. Social Distancing against
11 COVID-19: Implication for the Control of Influenza. *J Korean Med Sci* 2020; 35(19):e182.
- 12 11. Bin Nafisah S, Alamery AH, Al Nafesa A, Aleid B, Brazanji NA. School closure during
13 novel influenza: A systematic review. *J Infect Public Health* 2018; 11(5):657-661.
- 14 12. Halder N, Kelso JK, Milne GJ. Developing guidelines for school closure interventions to be
15 used during a future influenza pandemic. *BMC Infect Dis* 2010; 10:221.
- 16 13. Kelso JK, Milne GJ, Kelly H. Simulation suggests that rapid activation of social distancing
17 can arrest epidemic development due to a novel strain of influenza. *BMC Public Health*
18 2009; 9:117.
- 19 14. Oster Y, Michael-Gayego A, Rivkin M, Levinson L, Wolf DG, Nir-Paz R. Decreased
20 prevalence rate of respiratory pathogens in hospitalized patients during the COVID-19
21 pandemic: possible role for public health containment measures? *Clin Microbiol Infect* 2020;
22 27(5):811-812.

- 1 15. Heymann A, Chodick G, Reichman B, Kokia E, Laufer J. Influence of school closure on the
2 incidence of viral respiratory diseases among children and on health care utilization. *Pediatr*
3 *Infect Dis J* 2004; 23(7):675-677.
- 4 16. Kominers SD, Knoop CI. Maccabitech: The Promise of Israel's Healthcare Data. Harvard
5 Business School Case 819-032, February 2019.
- 6 17. Goldmann DA. Transmission of infectious diseases in children. *Pediatr Rev* 1992; 13(8):283-
7 293.
- 8 18. Thacker SB, Addiss DG, Goodman RA, Holloway BR, Spencer HC. Infectious diseases and
9 injuries in child day care. Opportunities for healthier children. *JAMA* 1992; 268(13):1720-
10 1726.
- 11 19. Amar S, Avni YS, O'Rourke N, Michael T. Prevalence of Common Infectious Diseases After
12 COVID-19 Vaccination and Easing of Pandemic Restrictions in Israel. *JAMA Netw Open*
13 2022; 5(2):e2146175.
- 14 20. Maison N, Peck A, Illi S, et al. The rising of old foes: impact of lockdown periods on "non-
15 SARS-CoV-2" viral respiratory and gastrointestinal infections. *Infection* 2022; 50(2):519-
16 524.
- 17 21. Moorthy M, Castronovo D, Abraham A, et al. Deviations in influenza seasonality: odd
18 coincidence or obscure consequence? *Clin Microbiol Infect* 2012; 18(10):955-962.
- 19 22. Israel Center for Disease Control. Respiratory viruses in Israel. Surveillance Report. Report
20 for week 27 ending 10-7-2021. [https://www.gov.il/BlobFolder/reports/corona-flu-
21 10072021/en/files_weekly-flu-corona_EN-2021_corona-flu-week-27-EN.pdf](https://www.gov.il/BlobFolder/reports/corona-flu-10072021/en/files_weekly-flu-corona_EN-2021_corona-flu-week-27-EN.pdf).

- 1 23. Pifarré I Arolas H, Vidal-Alaball J, Gil J, López F, Nicodemo C, Saez M.
2 Missing Diagnoses during the COVID-19 Pandemic: A Year in Review. *Int J Environ Res*
3 *Public Health* 2021; 18(10):5335.
- 4 24. Danino D, Ben-Shimol S, Van Der Beek BA, et al. Decline in Pneumococcal Disease in
5 Young Children during the COVID-19 Pandemic in Israel Associated with Suppression of
6 seasonal Respiratory Viruses, despite Persistent Pneumococcal Carriage: A Prospective
7 Cohort Study. *Clin Infect Dis* 2021; ciab1014

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1 **Table 1. Number of children included in the study, divided into age groups.**

2

Age Groups (years)	2019	2020
Total	776,828	777,729
0-1	70,942 (9.2%)	69,812 (8.8%)
1-6	225,435 (28.7%)	224,724 (28.2%)
6-12	256,865 (33.2%)	258,210 (32.4%)
12-18	223,586 (28.9%)	224,983 (30.7%)

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1 **Table 2. Infection rate in the two study groups.** Comparing Period 1 (January 1st-March 22nd, 2019) with Period 2 (March 23rd-July 31st, 2019) and
 2 Period 3 (January 1st-March 22nd, 2020) with Period 4 (March 23rd-July 31st, 2020, the lockdown period).

Disease	Period 1 ref.		Period 2		RR (95% CI)	P- value	Period 3 ref.		Period 4		RR (95% CI)	P- value
	N	%	N	%			N	%	N	%		
Total Number of Children with Infection	152,359	19.7	151,892	19.6	1 (0.99-1)	<.001	148,370	18.7	91,781	11.6	0.62 (0.61-0.62)	<.001
Acute Upper Respiratory Tract Infection, Common Cold	20739	2.7	13981	1.8	0.67 (0.66-0.69)	<.001	18274	2.3	9059	1.1	0.5 (0.48-0.51)	<.001
Influenza	11121	1.4	250	0.03	0.02 (0.02-0.03)	<.001	11174	1.4	80	0	0.01 (0.01-0.01)	<.001
Sore Throat, Tonsillitis Pharyngitis, Nasopharyngitis	22055	2.8	25305	3.3	1.15 (1.13-1.17)	<.001	24741	3.1	13563	1.7	0.55 (0.54-0.56)	<.001
Herpangina, Herpetic Gingivostomatitis	3310	0.4	5499	0.7	1.66 (1.59-1.73)	<.001	2703	0.3	2434	0.3	0.9 (0.85-0.95)	<.001
Acute Otitis Media	26983	3.5	22992	3	0.85 (0.84-0.87)	<.001	25331	3.2	9593	1.2	0.38 (0.37-0.39)	<.001
Bronchiolitis	4062	0.5	451	0.1	0.11 (0.1-0.12)	<.001	3059	0.4	237	0	0.08 (0.07-0.09)	<.001
Pneumonia, Bronchopneumonia	9540	1.2	5827	0.8	0.61 (0.59-0.63)	<.001	7192	0.9	887	0.1	0.12 (0.12-0.13)	<.001
Gastroenteritis, Diarrhea, Dysentery	16061	2.1	33752	4.4	2.1 (2.06-2.14)	<.001	14666	1.8	14354	1.8	0.98 (0.96-1)	<.001
Oxyuriasis	5389	0.7	7836	1	1.45 (1.4-1.51)	<.001	5212	0.7	6442	0.8	1.24 (1.19-1.28)	<.001
Urinary Tract Infection and Pyelonephritis	3060	0.4	4166	0.5	1.36 (1.3-1.43)	<.001	2878	0.4	3411	0.4	1.19 (1.13-1.25)	<.001
Impetigo	1517	0.2	3986	0.5	2.63 (2.48-2.79)	<.001	1922	0.2	2988	0.4	1.55 (1.47-1.65)	<.001
Conjunctivitis	19512	2.5	24591	3.2	1.26 (1.24-1.28)	<.001	18980	2.4	11628	1.5	0.61 (0.6-0.63)	<.001
Hand-Foot-and-Mouth Disease	770	0.1	1052	0.1	1.37 (1.25-1.5)	<.001	2275	0.3	342	0	0.15 (0.13-0.17)	<.001
Cellulitis	1690	0.2	3603	0.5	2.13 (2.01-2.26)	<.001	1666	0.2	2800	0.4	1.68 (1.58-1.79)	<.001
Fever	54562	7	53346	6.9	0.98 (0.97-0.99)	<.001	58086	7.3	35428	4.5	0.61 (0.6-0.62)	<.001

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1 **Table 3. Infection rate in the two study groups.** Comparing Period 1 (January 1st-March 22nd, 2019) with Period 3 (January 1st-March 22nd, 2020)
 2 and Period 2 (March 23rd-July 31st, 2019) with Period 4 (March 23rd-July 31st, 2020, the lockdown period). NS – not significant.

Disease	Period 1		Period 3		RR (95% CI)	p-value	Period 2		Period 4		RR (95% CI)	p-value
	N	%	N	%			N	%	N	%		
Total Number of Children with Infection	152,359	19.7	148,370	18.7	0.95 (0.94-0.96)	<.001	151,892	19.6	91,781	11.6	0.59 (0.58-0.59)	<.001
Acute Upper Respiratory Tract Infection, Common Cold	20739	2.7	18174	2.3	0.85 (0.84-0.87)	<.001	13981	1.8	9009	1.1	0.63 (0.61-0.65)	<.001
Influenza	11121	1.4	11115	1.4	0.97 (0.95-1)	NS	250	0.03	77	0	0.3 (0.23-0.39)	<.001
Sore Throat, Tonsillitis, Pharyngitis, Nasopharyngitis	22055	2.8	24586	3.1	1.09 (1.07-1.11)	<.001	25305	3.3	13417	1.7	0.52 (0.51-0.53)	<.001
Herpangina, Herpetic Gingivostomatitis	3310	0.4	2690	0.3	0.79 (0.75-0.83)	<.001	5499	0.7	2426	0.3	0.43 (0.41-0.45)	<.001
Acute Otitis Media	26983	3.5	25238	3.2	0.91 (0.97-1.03)	<.001	22992	3	9549	1.2	0.41 (0.4-0.41)	<.001
Bronchiolitis	4062	0.5	3046	0.4	0.73 (0.7-0.77)	<.001	451	0.1	236	0	0.51 (0.44-0.6)	<.001
Pneumonia, Bronchopneumonia	9540	1.2	7156	0.9	0.73 (0.71-0.75)	<.001	5827	0.8	886	0.1	0.15 (0.14-0.16)	<.001
Gastroenteritis, Diarrhea, Dysentery	16061	2.1	14599	1.8	0.89 (0.87-0.91)	<.001	33752	4.4	14259	1.8	0.41 (0.4-0.42)	<.001
Oxyuriasis	5389	0.7	5177	0.7	0.97 (0.9-0.97)	<.01	7836	1	6411	0.8	0.8 (0.77-0.82)	<.001
Urinary Tract Infection and Pyelonephritis	3060	0.4	2862	0.4	0.91 (0.87-0.96)	<.001	4166	0.5	3394	0.4	0.79 (0.76-0.83)	<.001
Impetigo	1517	0.2	1910	0.2	1.23 (1.15-1.31)	<.001	3986	0.5	2988	0.4	0.7 (0.7-0.77)	<.001
Conjunctivitis	19512	2.5	18885	2.4	1.23 (1.15-1.31)	<.001	24591	3.2	11559	1.5	0.46 (0.45-0.47)	<.001
Hand-Foot-and-Mouth Disease	770	0.1	2264	0.3	2.87 (2.64-3.11)	<.001	1052	0.1	342	0	0.32 (0.28-0.36)	<.001
Cellulitis	1690	0.2	1662	0.2	0.96 (0.9-1.03)	NS	3603	0.5	2786	0.4	0.75 (0.72-0.79)	<.001
Fever	54562	7	57803	7.3	1.03 (1.02-1.04)	<.001	53346	6.9	35023	4.4	0.64 (0.63-0.65)	<.001

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1 **Table 4. The number of children admitted to emergency centers, emergency rooms, and hospital wards in 2019 and in 2020.** Comparing
 2 Period 1(January 1st-March 22nd, 2019) with Period 3 (January 1st-March 22nd, 2020) and Period 2 (March 23rd-July 31st, 2019) with Period 4 (March
 3 23rd-July 31st, 2020, the lockdown period). NS – not significant.

Clinical setting	Period 1		Period 3		RR	P	Period 2		Period 4		RR	P
	N	%	N	%			N	%	N	%		
Ambulatory Emergency Care Center visits	5532	0.7	4645	0.6	0.82 (0.79-0.85)	<.001	9061	1.2	3910	0.5	0.42 (0.41-0.44)	<.001
Emergency room visits	18155	2.3	17488	2.2	0.94 (0.92-0.96)	<.001	29005	3.7	20908	2.6	0.70 (0.69-0.72)	<.001
Hospital admissions	7788	1	7801	1	0.98 (0.95-1.01)	NS	11954	1.5	8691	1.1	0.71 (0.69-0.73)	<.001

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10 **Table 5. Comparing purchase of antibiotics at the same time periods in 2019 and 2020.** Comparing Period 1(January 1st-March 22nd, 2019) with
 11 Period 3 (January 1st-March 22nd, 2020) and Period 2 (March 23rd-July 31st, 2019) with Period 4 (March 23rd-July 31st, 2020, the lockdown period).

	Period 1		Period 3		RR (95% CI)	p-value	Period 2		Period 4		RR (95% CI)	p-value
	N	%	N	%			N	%	N	%		
Purchase of Antibiotics	83869	10.8	70469	8.9	0.82 (0.81-0.83)	<.001	93684	12.1	55325	7	0.58 (0.57-0.58)	<.001