# Remote Versus In-person Outpatient Clinic Visits and Antibiotic Use Among Children During the COVID-19 Pandemic

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**Background:** The proportion of remote clinic visits was expected to increase among children during the COVID-19 pandemic which might result in antibiotic overuse.

**Methods:** In southern Israel, 2 ethnic groups, Jewish and Bedouin, live side-by-side. Computerized data on visits for children <18 years were examined from clinics with ≥50 insured children, active both pre-COVID-19 and during the COVID-19 pandemic. Visits were divided into in-person and remote. Monthly infectious diagnoses and dispensed antibiotic prescription rates were calculated by age (<5, 5–17 years) and ethnic groups. Mean monthly rates of 2 parallel seasons (pre-COVID-19 and COVID-19 periods) were compared.

**Results:** Overall 2,120,253 outpatient clinic visits were recorded. Remote clinic visit rates (per 1000 children) increased from 97.04 and 33.86 in the pre-COVID-19 to 179.75 and 50.05 in the COVID-19 period in Jewish and Bedouin children, respectively ($P < 0.01$) along with a reduction of in-person visit rates in both populations. Comparing pre-COVID-19 and COVID-19 periods, the rates of overall infectious diagnoses in remote visits increased. Nevertheless, dispensed antibiotic prescription rates in remote visits (per 1000 visits) remained unchanged (9.84 vs. 8.67, $P = 0.70$, in the Jewish population and 14.32 vs. 14.17, $P = 1.00$, in the Bedouin population in the pre-COVID-19 and COVID-19 periods, respectively) with a similar distribution of antibiotic categories.

**Conclusions:** COVID-19 pandemic resulted in an expansion of remote visits of children <18 years with an increase in infectious diagnoses. However, remote dispensed antibiotic prescription rates remained unchanged. These dynamics were more accentuated in Jewish children, characterized by higher socio-economic conditions, compared to Bedouin children.

**Key Words:** pediatric remote medicine, antibiotic use, COVID-19

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Since the beginning of the COVID-19 pandemic, outpatient healthcare providers offered remote medicine services, such as telemedicine and video calls. This was carried out for several reasons: (1) to overcome public fear of being exposed to the healthcare environment; (2) to allow accessibility during COVID-19 mitigation measures, which include reduced public transportation and (3) to allow accessibility for patients in quarantine.[1–4]

A major concern was that the increase in telemedicine might result in antibiotic overuse.[5,6] Foster et al[7] reported the risks of antibiotics overuse in pediatric outpatient telehealth services before the COVID-19 pandemic, using data from a large, national telemedicine provider including 560 physicians. Fifty-five percent of the visits resulted in antibiotic prescriptions with more than one-third of the prescriptions for broad-spectrum antibiotics. The American Academy of Pediatrics discouraged the use of telemedicine and suggested that it should be avoided in children <2 years.[8,9]

In southern Israel, 2 distinct ethnic groups, the Jewish and the Bedouin populations, live side-by-side. The Jewish population is largely urban, whereas the Bedouin population, formally desert nomads, is in transition to a Western lifestyle.[10] Eighty percent of the pediatric population receive medical services from the same Health Maintenance Organization (HMO), where all visits and dispensed drug prescriptions are computerized.[11]

The COVID-19 pandemic resulted in a substantial reduction in overall outpatient clinic visits in children compared to the 4 previous years. This reduction was mainly driven by the reduction in respiratory visits.[12]

Furthermore, early reports on antibiotic prescription rates during the first months of the COVID-19 pandemic showed a decline in antibiotic use beyond the expected seasonal decline, when compared to the same period in previous years.[13,14]

We assumed that the proportion of remote visits increased among children during the COVID-19 pandemic compared to the prepandemic era along with an increase in the rates of antibiotics that were prescribed during those visits. Therefore, our aim was to assess remote (virtual) vs. in-person rates of visits and dispensed antibiotic prescriptions in Jewish and Bedouin children in the prepandemic year and during the COVID-19 pandemic year.

## METHODS

### Study Population

In 2019 and 2020, ~308,800 and ~310,000 children <18 years old, respectively, inhabited the Negev region of southern Israel.[15,16] Two ethnic groups inhabit the Negev: The Jewish population, generally comparable to a Western population, and the Bedouin population, in transition from semi-nomadism to settlement, generally comparable to a developing population. When compared with the Jewish population (~156,725 in 2019), the Bedouin population (~152,032 in 2019) is characterized by overcrowding, lower income and education level and larger family size (median number of children of 2.9 and 5 for Jewish and Bedouin women, respectively).[17,18] Among the Bedouin children, respiratory infections rates and hospitalization for respiratory infections were more prevalent.[10,11] Dispensed antibiotic prescription rates were high but similar in both populations.[19] Social contacts between Bedouin and Jewish children are limited. Community medical services are provided mostly in separate clinics, located in different neighborhoods.

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Still, 9.8% of children received medical services in mixed Jewish-Bedouin clinics.

In 2019 and 2020, ~80% of all children <18 years old received medical services by the Clalit HMO. All Clalit HMO clinics in the Negev region with ≥50 insured children <18 years old, active throughout the study period, were included. The study was approved by the Ethics Committee of Soroka University Medical Center.

## COVID-19 in Israel

The daily number of COVID-19 patients in Israel, nationwide, along with the major non-pharmaceutical interventions (NPI) and COVID-19 immunization implementation are presented in Figure, Supplemental Digital Content 1, http://links.lww.com/INF/E730. Three peaks in the number of COVID-19 cases were noted during the study period, usually referred to as 3 waves. The first wave occurred in March 2020 and was followed by the first lockdown, which was the strictest NPI used. The second and the third peak, followed by the second and the third lockdowns, occurred in September and December 2020, respectively. The COVID-19 immunization program was implemented in Israel in late December 2020. During the study period, no COVID-19 vaccine was available for children <16 years old, only a small portion of children of 16–18 years have received the first dose of the vaccine by the end of January 2021.[20]

## Study Design

The study population comprised all children under the age of 18 years living in the Negev districts insured by the Clalit HMO in the study period. All clinic visits, visits diagnosis and dispensed antibiotic prescriptions were computerized. Overall clinic visits were divided into in-person visits and remote visits, synchronized telemedicine and video calls. Monthly overall visits diagnoses and monthly overall dispensed antibiotic prescription rates were calculated by age (<5, 5–17 years) and ethnic groups.

Visit diagnoses were divided into diagnoses categories: upper respiratory tract infections (URI), acute otitis media (AOM), lower respiratory tract infections (LRI), acute gastroenteritis (AGE), skin and soft tissue infections (SSTI), urinary tract infections (UTI), viral infection and fever, (Table, Supplemental Digital Content 2, http://links.lww.com/INF/E731). Antibiotic categories were divided into amoxicillin/amoxicillin-clavulanate, azithromycin, oral first and second-generation cephalosporins and all-other antibiotics (trimethoprim/sulfamethoxazole, erythromycin, clarithromycin and clindamycin). The median time of antibiotic -treatment in the outpatient setting was: 10 days for AOM, days for tonsilitis, 10 days for pneumonia (LRI), 10–14 days for UTI, 10 days for SSTI and 3 days for AGE.

## Analysis

This is a population-based ecological study conducted from February 2019 throughout January 2021, evaluating monthly incidence rates of clinic visits, visit diagnoses and dispensed antibiotic prescription rates for the same population. For comparison between the pre-COVID-19 period and the COVID-19 period, 2 parallel seasons were defined: June 2019–January 2020 and June 2020–January 2021. The first lockdown period (April 2020–May 2020) was excluded from comparison analysis. Mean monthly incidence rates with 95% confidence intervals for the COVID-19 period were calculated and compared by Student *t*-test to the pre-COVID-19 pandemic period. Monthly incidence rates were calculated for age group (children <5, 5–17 and <18 years) and ethnicity (Bedouin and Jewish children): overall visit rates were calculated per 1000 children insured and diagnoses and antibiotic rates were calculated per 1000 clinic visits. Diagnoses proportions were calculated of the sum of in-person and remote visits. Data were analyzed using SPSS 26.0 and R 4.03. A $P$ value of <0.05 was considered statistically significant.

# RESULTS

During the study period, 2,120,253 outpatients' clinic visits were recorded for children <18 years old. Of those, 662,014 (31%) were Bedouin children and 1,250,107 (59%) were Jewish children. In total 208,132 (10%) visits were recorded in mixed Jewish-Bedouin clinics.

## COVID-19 Pandemic Resulted in an Increase in Remote Visits and a Decrease of In-Person Clinic Visits

Mean monthly overall in-person clinic visit rates (per 1000 children) decreased from 395.28 and 260.36 in the pre-COVID-19 period to 253.35 and 178.57 in the COVID-19 period for Jewish and Bedouin children, respectively ($P < 0.01$). (Table 1, Fig. 1). The lowest rates were observed during the first lockdown period in April–May, (Table, Supplemental Digital Content 3, http://links.lww.com/INF/E732). Mean monthly overall remote clinic visit rates (per 1000 children) increased from 97.04 and 33.86 in the pre-COVID-19 period to 179.75 and 50.05 in the COVID-19 period in Jewish and Bedouin children, respectively ($P < 0.01$) (Table 1, Fig. 1). During 2020–2021 the overall clinic rates were 1.4 and 3.6-fold higher among Jewish than Bedouin children, for in-person and remote visits, respectively.

Rates of infectious diagnoses increased in remote clinic visits and decreased in in-person visits, comparing prepandemic and COVID-19 pandemic periods

The rates of the overall 8 most common infectious diagnoses (URI, AOM, LRI, AGE, SSTI, UTI, viral infection and fever) per 1000 visits were higher in in-person visits than remote visits in both pre-COVID-19 and COVID-19 period and in both ethnic groups (Table 1). However, overall infectious diagnosis rates (per 1000 visits) increased in remote visits when comparing pre-COVID-19 to COVID-19 periods, (131.8 vs. 150.9, $P = 0.118$, in Jewish children and 72.8 vs. 78.9, $P = 0.308$, in Bedouin children) and significantly decreased in in-person visits when comparing the two periods (528.5 vs. 345.4, $P < 0.01$ in Jewish children and 552.2 vs. 439.7, $P < 0.01$ in Bedouin children, in the pre-COVID-19 and COVID-19 periods, respectively). For each of the diagnoses, the proportion of remote visits versus in-person visits increased when comparing pre-COVID-19 to COVID-19 periods, and was more accentuated in Jewish children compared to Bedouin children, (Table 2).

## Antibiotic Prescription Rates in Remote Visits Compared With In-Person Visits in Both PrePandemic and COVID-19 Pandemic Periods

In general, overall dispensed antibiotic prescription rates (per 1000 visits) were lower in remote clinic visits than in in-person visits in both Jewish and Bedouin children: 9.80 vs. 37.50 in Jewish children and 14.32 vs. 63.7 in Bedouin children in the pre-COVID-19 period and 8.67 vs. 22.59 in Jewish children and 14.17 vs. 44.15 in Bedouin children during the COVID-19 period.

Overall dispensed antibiotic prescription rates given at in-person visits (per 1000 in-person visits) significantly decreased soon after the first lockdown period (from 37.5 to 22.59, $P < 0.001$ in the Jewish population and from 63.93 to 44.15, $P < 0.001$ in the Bedouin population) in all age groups, (Tables, Supplemental Digital Content 4, http://links.lww.com/INF/E733, and Supplemental Digital Content 5, http://links.lww.com/INF/E734). These reductions were similar to the reductions seen in the 8 most common infectious diagnoses (from 528.47 to 345.40, $P < 0.001$ in

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**TABLE 1.** Mean Monthly Rates of In-Person and Virtual Outpatient Visits and Dispensed Antibiotic Prescriptions during the Pre-COVID-19, First Lockdown and COVID-19 Periods in Children <18 Years Old

| | Pre COVID-19 Period | First Lockdown Period | COVID-19 Period | *P* value COVID-19 vs. Pre-COVID-19 Periods | Mean Difference COVID-19 vs. Pre-COVID-19 Periods | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|
| Jews | | | | | | Lower | Upper |
| In-person visits | | | | | | | |
| Overall visits (/1000 children) | 395.28 | 142.60 | 253.35 | <0.01 | −141.93 | −212.30 | −71.56 |
| All infectious diagnoses (/1000 visits) | 528.47 | 265.91 | 345.40 | <0.01 | −183.07 | −256.58 | −109.57 |
| Overall antibiotics (/1000 visits) | 37.50 | 27.03 | 22.59 | <0.01 | −14.91 | −17.66 | −12.16 |
| Amoxicillin/ amoxicillin-clavulanate (/1000 visits) | 25.38 | 17.59 | 15.03 | <0.01 | −10.34 | −12.63 | −8.06 |
| Azithromycin (/1000 visits) | 7.04 | 3.69 | 3.59 | <0.01 | −3.44 | −4.44 | −2.44 |
| 1st & 2nd cephalosporins (/1000 visits) | 3.89 | 5.04 | 3.38 | 0.63 | −0.51 | −1.27 | 0.26 |
| Other antibiotics (/1000 visits) | 1.20 | 0.71 | 0.58 | <0.01 | −0.62 | −0.81 | −0.43 |
| Virtual visits | | | | | | | |
| Overall visits (/1000 children) | 97.04 | 100.57 | 179.75 | <0.01 | 82.71 | 61.35 | 104.07 |
| All infectious diagnoses (/1000 visits) | 131.79 | 168.16 | 150.94 | 0.118 | 19.15 | −5.49 | 43.78 |
| Overall antibiotics (/1000 visits) | 9.84 | 15.58 | 8.67 | 0.70 | −1.17 | −2.91 | 0.56 |
| Amoxicillin/ amoxicillin-clavulanate (/1000 visits) | 5.71 | 10.49 | 5.53 | 1.00 | −0.18 | −1.48 | 1.12 |
| Azithromycin (/1000 visits) | 1.54 | 2.14 | 1.29 | 0.85 | −0.24 | −0.72 | 0.24 |
| 1st & 2nd cephalosporins (/1000 visits) | 1.60 | 1.86 | 1.27 | 0.57 | −0.33 | −0.90 | 0.23 |
| Other antibiotics (/1000 visits) | 1.00 | 1.09 | 0.58 | 0.16 | −0.42 | −0.84 | 0.00 |
| Bedouin | | | | | | | |
| In-person visits | | | | | | | |
| Overall visits (/1000 children) | 260.36 | 79.80 | 178.57 | <0.01 | −81.79 | −115.57 | −48.01 |
| All infectious diagnoses (/1000 visits) | 552.22 | 390.67 | 439.70 | <0.01 | −112.51 | −169.73 | −55.30 |
| Overall antibiotics (/1000 visits) | 63.93 | 52.77 | 44.15 | <0.01 | −19.78 | −24.78 | −14.78 |
| Amoxicillin/ amoxicillin-clavulanate (/1000 visits) | 44.98 | 31.88 | 29.23 | <0.01 | −15.74 | −19.66 | −11.83 |
| Azithromycin (/1000 visits) | 9.93 | 10.66 | 6.80 | <0.01 | −3.13 | −4.54 | −1.72 |
| 1st & 2nd cephalosporins (/1000 visits) | 6.39 | 7.09 | 6.59 | 1.00 | 0.19 | −1.39 | 1.78 |
| Other antibiotics (/1000 visits) | 2.63 | 3.14 | 1.53 | 0.01 | −1.10 | −1.65 | −0.55 |
| Virtual visits | | | | | | | |
| Overall visits (/1000 children) | 33.86 | 32.10 | 50.05 | <0.01 | 16.19 | 12.11 | 20.27 |
| All infectious diagnoses (/1000 visits) | 72.84 | 105.29 | 78.92 | 0.31 | 6.08 | −6.25 | 18.42 |
| Overall antibiotics (/1000 visits) | 14.32 | 23.52 | 14.17 | 1.00 | −0.14 | −3.98 | 3.69 |
| Amoxicillin/ amoxicillin-clavulanate (/1000 visits) | 8.25 | 13.44 | 7.12 | 0.98 | −1.13 | −3.55 | 1.29 |
| Azithromycin (/1000 visits) | 2.25 | 5.73 | 2.74 | 1.00 | 0.48 | −0.42 | 1.39 |
| 1st & 2nd cephalosporins (/1000 visits) | 1.85 | 2.97 | 2.15 | 1.00 | 0.29 | −0.52 | 1.11 |
| Other antibiotics (/1000 visits) | 1.96 | 1.37 | 2.17 | 1.00 | 0.21 | −1.20 | 1.62 |

the Jewish population and from 552.22 to 439.7, $P < 0.001$ in the Bedouin population), (Table 1, Figure, Supplemental Digital Content 1, http://links.lww.com/INF/E730).

Overall dispensed antibiotic prescription rates given during remote visits (per 1000 remote visits) temporarily increased during the first lockdown period in both ethnic groups, but soon after restriction relief, rates returned to pre-COVID-19 expected rates in both age and ethnic groups, 9.84 vs. 8.67, $P = 0.70$, in the Jewish population and 14.32 vs. 14.17, $P = 1.00$, in the Bedouin population, in the pre-COVID-19 and COVID-19 period, respectively, (**Table 1**, Tables, Supplemental Digital Content 4, http://links.lww.com/INF/E733, Supplemental Digital Content 5, http://links.lww.com/INF/E734, Figure, Supplemental Digital Content 6, http://links.lww.com/INF/E735). Amoxicillin/amoxicillin-clavulanate, the most prescribed antibiotics, rates dynamics followed the trends of overall antibiotics in both remote and in-person visits in both ethnic groups, (Table 1, Figure, Supplemental Digital Content 1, http://links.lww.com/INF/E730).

Azithromycin rates remained unchanged in remote visits comparing pre versus COVID-19 periods in both ethnic groups and significantly decreased in in-person visits (Table 1).

No significant changes were found in first and second-generation oral cephalosporins rates in both remote and in-person visits comparing pre-COVID-19 and COVID-19 periods, in both ethnic groups (Table 1).

## Antibiotic Category Distribution in Remote and In-Person Visits in the Pre-COVID-19 Period and During the COVID-19 Pandemic Period

The most frequently prescribed antibiotic category was amoxicillin/amoxicillin-clavulanate followed by azithromycin and oral cephalosporins, in both prepandemic and pandemic periods. These proportions did not differ by visit type or ethnic group, (Figure, Supplemental Digital Content 6, http://links.lww.com/INF/E735). However, the proportion of other antibiotics (trimethoprim/sulfamethoxazole, erythromycin, clarithromycin and clindamycin) were significantly higher in remote visits than in in-person visits in both ethnic groups. The proportion of first and second-generation oral cephalosporins given at in-person visits significantly increased when comparing pre-COVID-19 to COVID-19 period ($P < 0.01$) in both ethnic groups.


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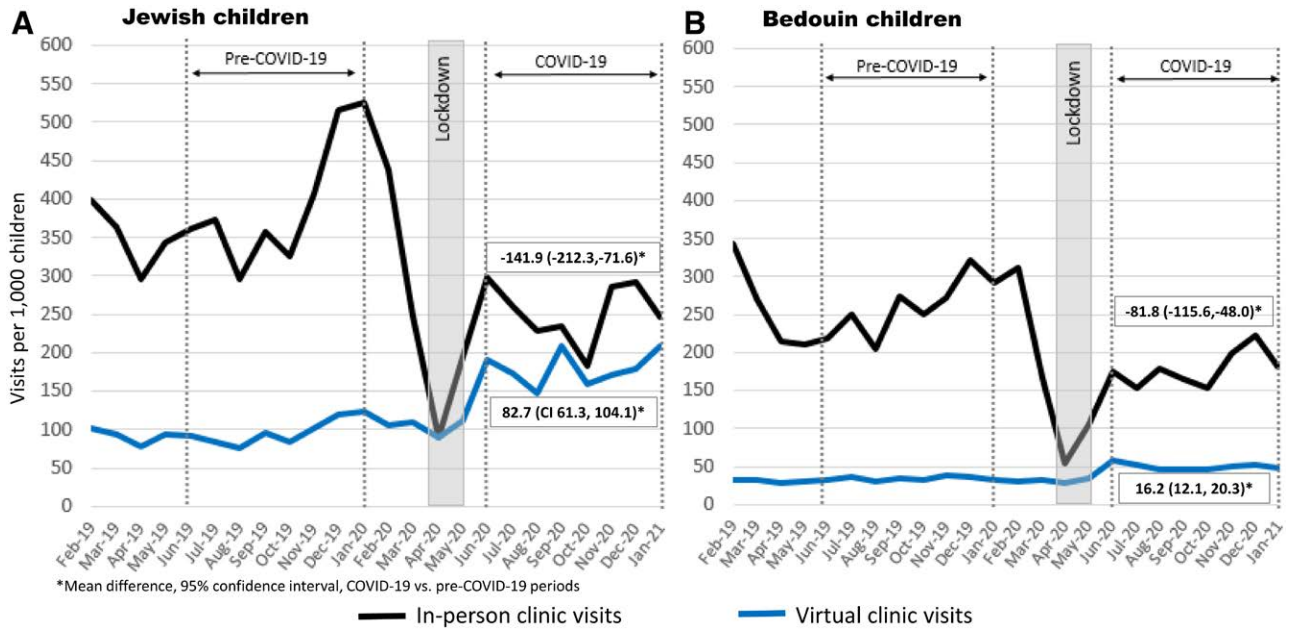


**FIGURE 1.** Monthly incidence rates of in-person and virtual outpatient clinic visits, children <18 years of age, February 2019 through January 2021. full color online

## DISCUSSION

The COVID-19 pandemic year resulted in an increase in outpatient remote clinic visits rates as well as a reduction in in-person visits rates in children <18 years in southern Israel. Notably, the rates of the 8 most common infectious diagnoses in remote visits increased when comparing pre-COVID-19 and COVID-19 periods. Nevertheless, dispensed antibiotic prescription rates in remote visits (per 1000 visits) remain unchanged with a similar distribution of antibiotic categories. These dynamics were more accentuated in Jewish children, characterized by higher socioeconomic and living conditions,[10] compared to Bedouin children.

Remote medicine may limit the proper assessment of symptoms, as in acute otitis media that requires otoscopy examination for an accurate diagnosis. Previous retrospective studies that examined administrative databases found that the virtual delivery of care was associated with less diagnostics testing and more empiric antibiotic prescribing than in-person visits.[21] Overuse of antibiotics resulting in increased antibiotic resistance is a major global concern that led to antibiotic stewardship efforts and educational programs worldwide.[22,23]

In our study, although the proportion of infectious diagnoses increased in remote visits when comparing the pre-COVID-19 to COVID-19 periods, dispensed antibiotic prescription rates remain unchanged and amoxicillin/amoxicillin-clavulanate, the most prescribed antibiotics for acute respiratory tract infections, was the most frequent antibiotics in both years.

We studied 2 distinct ethnic populations which differ in many aspects. Overall, higher outpatient visits rates were found in Jewish than in Bedouin children, despite overcrowding and higher respiratory infection rates prevalent among the Bedouin children. This might be explained by a higher use of independent unaffiliated physicians and higher rates of emergency department visits among the Bedouins, both not recorded in the HMO computerized system.

Remote medicine requires knowledge and upskilling to use virtual technology equipment, thus developing populations may not be able to fully adopt telemedicine and video calls, specifically in remote rural areas.[24–26] Therefore, it was not surprising that remote visits rates were significantly higher in the Jewish population than in the Bedouin population. These disparities in the use of remote medicine between different ethnic groups are worrisome and will need to be addressed, considering that remote medicine will continue to be used in pediatric practice in the future following the pandemic. Nevertheless, similar dynamics in remote visits rates, remote visits diagnoses and remote antibiotic prescription rates were found in both populations.

In-person outpatient clinic visits decreased when compared between the pre-COVID-19 and the COVID-19 periods, including a decrease in all visits with infectious diagnoses and a marked reduction in dispensed antibiotic prescription rates. Indeed, multiple worldwide reports have pointed to reduced pediatric clinic visits and hospitalizations during the pandemic, mainly for respiratory diseases.[12,27–29] In addition, early reports on antibiotic prescription rates during the first months of the COVID-19 pandemic showed a decline in antibiotic use beyond the expected seasonal decline, as compared to the same period in previous years.[13,14]

The first lockdown period in Israel was extremely strict and included the closure of all educational facilities, movement and travel restrictions (limited to within 100 meters from home), discontinuation of nonessential work and commerce, no public gathering, limited public transportation, closing of prayer services and closing of airport both for outgoing and incoming flights.[20] Sharp changes in clinic visit trend dynamics were thus observed during the months of April and May 2020 and were accompanied by a temporary worrisome increase in antibiotic use in remote clinic visits in both populations. However, soon after the relief of those restrictions this injudicious antibiotic prescribing returned to near expected rates compared to the same period in the previous year.

Limitations of the study include methodology that relies on coding reports for visit diagnoses, and consequently, results might be influenced by coding variations between individual providers or clinics and may inherently contain missing or inaccurate data. Nevertheless, the HMO coding system (which is a modification of the International Classification of Diseases-9 coding) did not change throughout the study period. Additionally, we cannot rule out other

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**TABLE 2.** Diagnoses Proportions in Pre- COVID-19, First Lockdown Period and COVID-19 Periods in Children <18 Years Old

| | Pre COVID-19 Period | First Lockdown Period | COVID-19 Period | *P* value COVID-19 vs. pre-COVID-19 Periods | Mean Difference COVID-19 vs. Pre-COVID-19 Periods | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|
| Jews | | | | | | Lower | Upper |
| In-person visits | | | | | | | |
| Proportion of in-person visits | | | | | | | |
| All infectious diagnoses | 94.20 | 67.41 | 76.08 | <0.001 | −18.12 | −21.00 | −15.23 |
| Viral infection | 94.87 | 74.31 | 76.40 | <0.001 | −18.46 | −21.67 | −15.26 |
| AGE | 92.30 | 60.07 | 66.97 | <0.001 | −25.33 | −29.56 | −21.11 |
| Fever | 92.20 | 58.74 | 67.63 | <0.001 | −24.57 | −28.15 | −20.98 |
| LRI | 95.12 | 67.51 | 85.60 | 0.001 | −9.52 | −13.59 | −5.44 |
| AOM | 96.71 | 72.47 | 85.36 | <0.001 | −11.35 | −13.78 | −8.92 |
| SSTI | 95.03 | 74.91 | 84.35 | <0.001 | −10.69 | −13.76 | −7.61 |
| URI | 94.95 | 72.84 | 79.75 | <0.001 | −15.20 | −17.10 | −13.30 |
| UTI | 77.66 | 56.48 | 59.57 | <0.001 | −18.09 | −22.30 | −13.88 |
| Virtual visits | | | | | | | |
| Proportion of virtual visits | | | | | | | |
| All infectious diagnoses | 5.80 | 32.59 | 23.92 | <0.001 | 18.12 | 15.23 | 21.00 |
| Viral infection | 5.13 | 25.69 | 23.59 | <0.001 | 18.46 | 15.26 | 21.66 |
| AGE | 7.69 | 39.92 | 33.03 | <0.001 | 25.33 | 21.11 | 29.56 |
| Fever | 7.80 | 41.26 | 32.37 | <0.001 | 24.57 | 20.98 | 28.15 |
| LRI | 4.88 | 32.49 | 14.40 | 0.001 | 9.52 | 5.44 | 13.59 |
| AOM | 3.29 | 27.52 | 14.64 | <0.001 | 11.35 | 8.92 | 13.78 |
| SSTI | 4.96 | 25.09 | 15.65 | <0.001 | 10.69 | 7.61 | 13.76 |
| URI | 5.05 | 27.15 | 20.25 | <0.001 | 15.20 | 13.30 | 17.10 |
| UTI | 22.34 | 43.52 | 40.43 | <0.001 | 18.09 | 13.88 | 22.30 |
| Bedouin | | | | | | | |
| In-person visits | | | | | | | |
| Proportion of in-person visits | | | | | | | |
| All infectious diagnoses | 98.27 | 89.25 | 95.16 | <0.001 | −3.12 | −3.82 | −2.41 |
| Viral infection | 98.95 | 88.35 | 97.14 | 0.004 | −1.81 | −2.88 | −0.73 |
| AGE | 95.86 | 81.32 | 90.02 | <0.001 | −5.85 | −7.00 | −4.69 |
| Fever | 97.77 | 84.32 | 92.29 | <0.001 | −5.49 | −6.44 | −4.53 |
| LRI | 99.00 | 95.83 | 98.62 | 0.466 | −0.38 | −1.51 | 0.75 |
| AOM | 99.55 | 94.33 | 98.23 | 0.001 | −1.32 | −1.93 | −0.70 |
| SSTI | 98.56 | 92.12 | 95.44 | <0.001 | −3.12 | −4.34 | −1.89 |
| URI | 98.91 | 92.51 | 96.98 | <0.001 | −1.93 | −2.47 | −1.38 |
| UTI | 82.29 | 70.95 | 75.33 | <0.001 | −6.96 | −10.26 | −3.67 |
| Virtual visits | | | | | | | |
| Proportion of virtual visits | | | | | | | |
| All infectious diagnoses | 1.72 | 10.74 | 4.84 | <0.001 | 3.12 | 2.41 | 3.82 |
| Viral infection | 1.04 | 11.65 | 2.85 | 0.004 | 1.81 | 0.73 | 2.88 |
| AGE | 4.13 | 18.68 | 9.98 | <0.001 | 5.85 | 4.69 | 7.00 |
| Fever | 2.23 | 15.68 | 7.71 | <0.001 | 5.49 | 4.53 | 6.44 |
| LRI | 0.10 | 4.17 | 1.38 | 0.466 | 0.38 | −0.75 | 1.51 |
| AOM | 0.45 | 5.67 | 1.77 | 0.001 | 1.32 | 0.70 | 1.93 |
| SSTI | 1.44 | 7.88 | 4.56 | <0.001 | 3.12 | 1.89 | 4.34 |
| URI | 1.09 | 7.49 | 3.01 | <0.001 | 1.93 | 1.38 | 2.47 |
| UTI | 17.70 | 29.05 | 24.67 | <0.001 | 6.96 | 3.67 | 10.26 |

AGE indicates acute gastroenteritis;AOM, acute otitis media; LRI, lower respiratory tract infections; SSTI, skin and soft tissue infections; URI, upper respiratory tract infections; UTI, urinary tract infections.

factors which could potentially play a role in diagnosis or antibiotic prescription, although no significant changes in guidelines occurred and no limitations for the use of specific medications were imposed and no active antibiotic stewardship program was initiated.

Our study is the first population-based study that combined data on both visit diagnoses and dispensed antibiotic prescription rates during in-person versus remote visits that were conducted throughout a whole COVID-19 pandemic year, including baseline data starting a year before the pandemic. Our analysis included an adjustment to age and seasonality. In addition, we studied 2 ethnic populations differing in many aspects including socioeconomic status and accessibility to remote medicine, with minimal contact between them and we found generally similar trends in the developing and developed populations that add strength to our findings.

We believe that the Clalit HMO unique system in which the patients were seen virtually by their own pediatrician,[30] and where referral to in-person evaluation did not incur additional fees, and where medical services provided via telemedicine are compensated in the same way as are in-person visits seems beneficial in terms of antibiotic use. These findings are reassuring assuming that remote medicine modalities are used in the future pediatric practice following the pandemic. However, a long-term follow-up is needed to evaluate postpandemic antibiotic use levels.

In summary, the COVID-19 pandemic resulted in an expansion of remote visits in children <18 years old along with an increase in infectious diagnoses. However, remote dispensed antibiotic prescription rates remained unchanged comparing the pre-COVID-19 to the COVID-19 periods and were lower than in-person visit rates in both years. Trends of visit rates, visit diagnoses and


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dispensed antibiotic prescription rates were similar in both Jewish and Bedouin children and in all age groups.

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