The dynamics of intrafamilial spread of SARS-CoV-2 during January–February 2021 when variant B.1.1.7 predominated were compared with data from April to May 2020, when other circulating variants prevailed. Much higher intrafamilial transmission rates among all age groups, in particular in young children, and lower rates of sensory impairment were demonstrated during January–February 2021.

Key Words: COVID-19, SARS-CoV-2, B.1.1.7, variant, sensory impairment, transmission

Since the introduction of the SARS-CoV-2 lineage B.1.1.7 in Israel in December 2020, it has spread widely and by mid-February 2021, it has become the predominant circulating variant in 70%–80% of cases. The B.1.1.7 variant has been reported to affect both the dynamics of intrafamilial spread as well as the pattern of symptomatology in both children and adults, the results of which are reported here.

METHODS

The study was undertaken in the city of Bnei Brak in Central Israel. This city has been an epicenter of COVID-19 epidemic in Israel.

Bnei Brak is a “young” and crowded city. Children 0–19 years of age comprise almost 50% of its 200,000 population, and the average number of children in a family is 4.57. Clusters of infections within families living in Bnei Brak were identified and investigated. The parents were asked regarding the first case of the infection in the family and regarding the presumed source of the infection. All household members underwent polymerase chain reaction testing whether they were symptomatic or not since the index cases were not effectively isolated from the other household members.

Sensory impairment was evaluated by responses to questions regarding the presence or lack of olfactory and gustatory dysfunction. A scoring system of 0–2 was attributed to each sense: smell and taste. Accordingly, 0 represented no loss of sense (taste or smell), 1 mild loss, and 2 complete loss, for a total score per individual of 0–4. The analysis of sensory impairment did not include children 0–10 years of age to increase the reliability and objectivity of the data.

The results of this study were compared with those of previous studies conducted in April–May 2020 by the same investigators under the same conditions. Fisher’s exact probability and χ² tests were used to test for significant differences.

The study was approved by the ethics committee at the Mayanei Hayeshua Medical Center, Israel.

RESULTS

Fifteen family clusters were investigated; age of participants ranged from 2 months to 55 years. Index cases were omitted from the analysis to prevent biased higher rates in adults since, in 11 of 15 clusters, the index case that led to testing the household was an adult. In the other 4 cases, the index cases were children with 17.5, 13.5, 13, and 6 years of age.

SARS-CoV-2 Infection Rates

SARS-CoV-2 positive polymerase chain reaction was documented in 90.4% of adults (≥18 years), in 75% of children 6–17 years of age, and in 72% of children 0–5 years of age. These rates were significantly higher than the rates documented in the April 2020 survey (Table 1).

Sensory Impairment

In total, 14 of 61 participants with >11 years of age (22.9%) reported having some impairment of taste or smell. This included 40% of the adults 18 years of age and older and 7.4% children 11−17 years of age. These rates were significantly lower than the rates documented in the April 2020 survey (71.5% and 40% for adults and children 11−17 years of age, respectively). Sensory impairment scores were also significantly lower in adults and children 11−17 years of age than the scores reported in 2020 survey (Table 2).

Other Symptoms

Most family members had mild illness and none of them required out of home medical care including hospitalization for further evaluation or treatment. Children had significantly higher rates of asymptomatic infections than adults (49.2% vs. 13.3%, respectively, P = 0.007).

DISCUSSION

This study demonstrates much higher intrafamilial transmission rates of the B.1.1.7 variant than with circulation of previously circulating variants (mostly, clades GH and GR) among all age groups, in particular in young children.

While this study was not designed to assess the severity of illness caused by B.1.1.7 variant, most participants had mild illness and none required out of home medical evaluation. Nonetheless, there were strikingly lower rates of elicited sensory impairment and overall lower impairment scores associated with the circulation of B.1.1.7 variant in adults and children.

The reasons for the difference in sensory impairment are not clear. It has been hypothesized that mutations within the receptor-binding domain virus’ spike glycoprotein can modify the likelihood and the extent of infection of the olfactory and oral epithelium and thereby influence the degree of olfactory and gustatory dysfunction. A recent survey from the United Kingdom implied...
a slight reduction in sensory impairment in SARS-CoV-2 infected individuals evaluated during January 2021 when variant B.1.1.7 predominated compared with those infected between November to December 2020.8

The unique environmental circumstances with crowded families and without effective isolation of index cases could have certainly contributed to increased transmission rates. However, the previous assessment of transmission rates was performed with the same population and the same environmental conditions; therefore, we believe that the difference observed in transmission is real.

The main limitations are the relatively small size of sample and that respiratory specimens were not processed for viral sequencing. However, the results were significant despite the sample size. It is also reasonable to attribute the differences in transmission and in sensory involvement detected in this study to the circulation of B.1.1.7 variant during the study period. The main strength of the study is the ability to evaluate the differential impact of the circulating COVID-19 variants on the examined parameters since the comparison was done under almost identical conditions.

In conclusion, intrafamilial SARS-CoV-2 infection during predominant circulation of B.1.1.7 variant is much more effective in all age groups and associated with less sensory impairment.

### REFERENCES


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### TABLE 1. Intrafamilial Transmission of SARS-CoV-2 Infection During January–February 2021 and April–May 2020*

<table>
<thead>
<tr>
<th>Intrafamilial Transmission</th>
<th>Adults (≥18 yrs)</th>
<th>Children (6–17 yrs)</th>
<th>Children (0–5 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Susceptible*</td>
<td>Number of Infected (%)</td>
<td>Number of Susceptible</td>
</tr>
<tr>
<td>January–February 2021 survey</td>
<td>21</td>
<td>19 (90.4)</td>
<td>52</td>
</tr>
<tr>
<td>April–May 2020 survey†</td>
<td>37</td>
<td>22 (59)</td>
<td>40</td>
</tr>
<tr>
<td>P</td>
<td>0.02</td>
<td>&lt;0.001</td>
<td>0.012</td>
</tr>
<tr>
<td>RR [95% CI]</td>
<td>1.6 (1.2–2.1)</td>
<td>2.5 (1.8–4.0)</td>
<td>7.8 (2.1–29.0)</td>
</tr>
<tr>
<td>Symptoms*</td>
<td>Number of infected: 30†</td>
<td>Number of infected: 43†</td>
<td>Number of infected: 25†</td>
</tr>
<tr>
<td>No symptoms</td>
<td>4</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Mild</td>
<td>20</td>
<td>25</td>
<td>11</td>
</tr>
<tr>
<td>Moderate</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Index cases were omitted from the analysis.
†Related to participants from 2021 survey and including index cases. The 2020 survey did not include investigation of symptoms.
‡RR indicates rate ratio; CI, confidence interval.

### TABLE 2. Sensory Impairment of SARS-CoV-2 Infection During January–February 2021 and April–May 2020*

<table>
<thead>
<tr>
<th>Adults (≥18 yrs)</th>
<th>Children (11–17 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of SARS-CoV-2 Infected</td>
<td>Number With Sensory Impairment (%)</td>
</tr>
<tr>
<td>January–February 2021 survey</td>
<td>30</td>
</tr>
<tr>
<td>April–May 2020 survey†</td>
<td>42</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>RR [95% CI]</td>
<td>0.56 (0.34–0.9)</td>
</tr>
</tbody>
</table>

*Index cases were omitted from the analysis.
†Scoring of 0–2 was attributed to each sense: smell and taste: 0 represented no loss of sense; 1, mild loss; and 2, complete loss.
‡Related to participants from 2021 survey and including index cases. The 2020 survey did not include investigation of symptoms.

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