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## Letter to the Editor

### Parallel reduction in the prevalence of Bell's palsy, idiopathic sudden sensorineural hearing loss and viral infection diseases during the COVID-19 pandemic

## Dear Editor

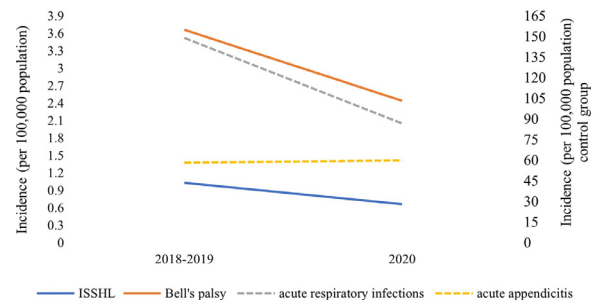
New publications describing the effect of control measures for COVID-19 on reducing known infectious diseases such as tuberculosis and influenza<sup>1</sup> raised our interest examining those effects on diseases whose etiology remains uncertain. Our aim was to determine whether their etiology can be explained through the restrictions for preventing the spread of Covid-19. Bell's palsy (BP) and idiopathic sudden sensorineural hearing loss (ISSHL) are idiopathic diseases causing disabling symptoms and great distress among patients. One of the possible pathogenetic mechanisms of these diseases is thought to be related to an external contagious pathogen, exposure to which might be affected by the COVID-19 social restrictions. Decline in the incidence of BP and ISSHL, will reinforce the assumption that a viral factor underlying their pathogenesis. A better understanding of the etiological factors for these diseases may help to prevent and treat them.

BP it is the most common acute mono-neuropathy, limiting facial muscle movement on the affected side.<sup>2</sup> BP has a self-limiting effect, but can cause an inability to close the eyelid, leading to a potential of irreversible eye injury. One of the etiologies suggested for BP is viral infection.<sup>3</sup>

ISSHL is characterized as sudden deafness from the cochlear or retro-cochlear origin. Delay in diagnosis is a common problem, that in turn can result in treatment delay, which is linked to irreversible hearing loss. ISSHL, like BP, is suggested to be caused by viral infection.<sup>4</sup>

In December 2019, a new coronavirus was identified, which was responsible for an outbreak of pneumonia in Wuhan city, Hubei province in China. The virus spread rapidly to become a global pandemic. At the end of February 2020, COVID-19 began spreading in Israel. The Israeli government promoted legislation for isolation and instructions to eradicate the spread of COVID-19. Among those guidelines: wearing a face mask in public spaces, maintaining a distance of at least two meters between people, banning crowded events, school closures, and entering quarantine.

This study was conducted as an observational, analytical, and retrospective manner. Information was collected from existing medical records during the pandemic, quarantine, and similar periods in previous years between 2018 and 2020. Patients suffering from acute respiratory infection and acute appendicitis served as controls. These different control groups allowed us to compare the



**Fig. 1.** Annual incidences of ISSHL and BP and the control groups between the years 2018-2019 and 2020. The left axis represents the research group (ISSHL, BP) while the right axis represents the control group (acute respiratory infections, acute appendicitis).

research groups and examine which pattern of behavior they are mimicking. For calculating incidence rates, data was taken from publications of the Central Bureau of Statistics and the local district office of the Ministry of Health. Exclusion criteria were disease recurrence less than one month apart, and re-hospitalization within one month.

Incidence analysis was based on persons years period and was calculated for each disease before and after the SARS-CoV-2 outbreak, using the chi-squared test or Fisher's exact test (if expectancy <5). We performed multivariable regression models using the "difference-in-difference" method between the investigated diseases both before and after the SARS-CoV-2 outbreak and restrictions. The "difference-in-difference" value was considered statistically significant if the 95% CI did not include 0. The analysis was performed using IBM SPSS Statistics version 27. A significance value lower than 5% was considered statistically significant. This study received approval from our institutional review board.

Overall, we identified 12 cases of ISSHL (5 [41.7%] female; median age 49 years), 43 cases of BP (21 [48.8%] female; median age 52 years), 1693 cases of acute respiratory infections (900 [53.2%] female; median age 51 years), and 779 cases of acute appendicitis (335 [43%] female; median age 34 years) respectively.

We found a decrease in the annual incidences in 2018-2019 compared to 2020 in both ISSHL, BP, and acute respiratory infections (1.03, 0.665,  $p = 0.762$ ; 3.662, 2.441,  $p = 0.265$ ; 149.028, 86.792,  $p < 0.001$  respectively), unlike the annual incidences of acute appendicitis (58.26, 59.933,  $p = 0.705$ ) (Fig. 1). These decreases in 2020 of acute respiratory infections, ISSHL, and BP incidences can be associated with SARS-CoV-2 restrictions, thus reducing and preventing the spread of any viral infections.<sup>5</sup> There was an interaction between acute appendicitis and acute respiratory infections (DID = -0.224, 95% CI -0.422 to -0.026), and between acute respiratory infections and ISSHL (DID = 0.231, 95% CI 0.054 to 0.408). Statistical interaction between acute respiratory in-

Abbreviations: BP, Bell's palsy; ISSHL, Idiopathic sudden sensorineural hearing loss.

**Table 1**

Multivariable regression models assessing the "difference-in-difference" between the investigated diseases before and after the SARS-CoV-2 outbreak and restriction.

Model	DID	95% CI	R <sup>2</sup>
Acute appendicitis vs Acute respiratory infections	-0.224	<b>-0.422 to -0.026</b>	.475
Acute appendicitis vs Bell's palsy	-0.023	-0.226 to 0.181	.873
Acute appendicitis vs ISSHL	0.008	-0.166 to 0.183	.930
Acute respiratory infections vs Bell's palsy	0.200	-0.005 to 0.405	.920
Acute respiratory infections vs ISSHL	0.231	<b>0.054 to 0.408</b>	.953

fections and acute appendicitis, indicates they have a different pattern, making them appropriate control groups. Using "difference-in-difference", we discovered that BP did not interact with any of the other diseases, neither with acute respiratory disease nor acute appendicitis. There was, however, an interaction between acute respiratory infections and ISSHL, and no interaction between acute appendicitis and ISSHL (Table 1). Perhaps ISSHL had the same pattern as acute appendicitis and did not truly decrease in 2020. ISSHL can be a non-specific symptom of SARS-CoV-2.<sup>6</sup> As the SARS-CoV-2 pandemic spread there were probably more cases where ISSHL was the sole presentation of the disease, therefore, not presenting a statistical interaction with acute appendicitis. Another possible explanation is related to small number of ISSHL cases in the research group, therefore the decline in other studies is not represented.<sup>7</sup>

Although BP, like ISSHL, has been reported as a non-specific symptom of SARS-CoV-2 infection, we were still able to show a decrease in their annual incidence compared to acute appendicitis.<sup>8</sup> The connection and mechanism of SARS-CoV-2 as a cause of ISSHL and BP require further learning and research.

This study is retrospective and has limitations. The data included is based on electronic medical records that may represent incorrect ICD-9 codes. There may have been patients who did not reach the emergency room, due to fear of exposure to COVID-19 patients. Our small study groups made it hard to reach statistical significance. Further research on a larger national or regional scale will help to get a better assessment of the incidences of ISSHL and BP during the pandemic.

The parallel reduction in the prevalence of BP and ISSHL and a viral infection disease demonstrated in this study strengthens the possible role of viral infections in their etiology. Further research on larger scales should be conducted to further strengthen this hypothesis. This research was conducted before SARS-CoV-2 vaccines were distributed worldwide.

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## Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## About the Authors

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## Declaration of Competing Interest

The authors have no conflict of interest to declare.

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