


- 2 Grünert SC, Schmitt RN, Schlatter SM *et al.* Clinical presentation and outcome in a series of 32 patients with 2-methylacetoacetyl-coenzyme A thiolase (MAT) deficiency. *Mol. Genet. Metab.* 2017; **122**: 67–75.
- 3 Thomas JA. Organic acidemias. In: Bernstein LE, Rohr F, Helm JR (eds). *Nutrition management of inherited metabolic diseases*. Springer International Publishing, 2015; 187–201.
- 4 Hori T, Yamaguchi S, Shinkaku H *et al.* Inborn errors of ketone body utilization. *Pediatr. Int.* 2015; **57**: 41–8.
- 5 Wolfsdorf JJ, Glaser N, Agus M *et al.* ISPAD Clinical Practice Consensus Guidelines 2018: Diabetic ketoacidosis and the hyperglycemic hyperosmolar state. *Pediatr. Diabet.* 2018; **19** (Suppl 27): 155–77.

## Incidence of appendicitis during SARS-CoV-2 pandemic quarantine

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There has recently been an increasing interest in the influence of sex, socioeconomic status, and other factors on outcomes from acute illness. Sex influences the progression of common medical conditions. Sex also appears to influence susceptibility to immune-based diseases.<sup>1–2</sup>

An interesting paper reported that there is age-related variation in the incidence of non-perforating appendicitis;<sup>4</sup> a relatively recent increase in non-perforating appendicitis was due to early diagnosis and lower thresholds for referring patients to surgery.

It has been reported that the lifetime risk of developing appendicitis is about 9% for males and about 7% for females. Rurality has been shown to be a predictor of worse surgical outcomes compared to those for urban residents.<sup>1–5</sup>

Among the common causes of appendicitis, obstruction of the appendiceal lumen by a fecalith and hyperplasia of the lymphoid follicle have been proposed. It has been reported that appendicitis has a higher incidence in communities with high consumption of potatoes, sugar, and cereals and a lower incidence in communities with high consumption of non-potato vegetables. The resulting improvements in hygiene greatly reduced young children's exposure to enteric organisms and, it is argued, could have altered their responses to infection in later years in such a way that acute appendicitis was triggered.<sup>3–5</sup>

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In view of the SARS-CoV-2 outbreaks and the two quarantine phases (phase 1 quarantine between March 1 and April 1, and the phase 2 progressive opening from the first days of April to date) in our specific area (Verona, Veneto, Italy), many hospitals have been declared COVID-19 hospitals and have been closed for elective activity.

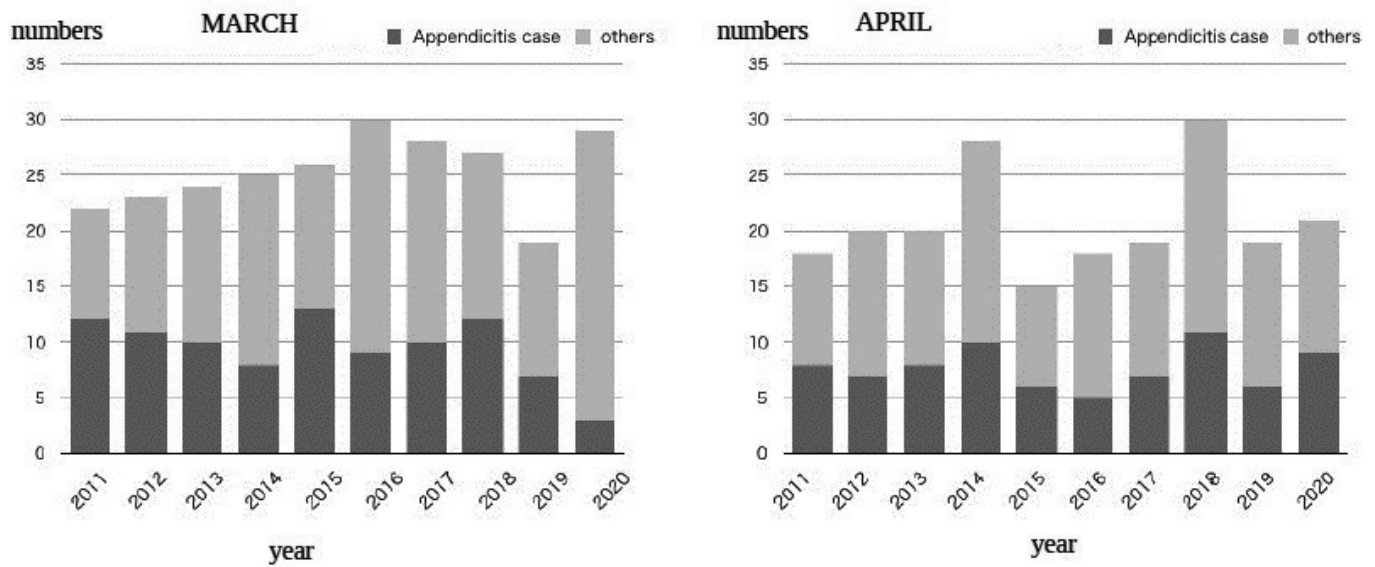
Our is a tertiary university hospital, with the only pediatric surgical unit in this macro-area (covering 930 000 people). In our area, there are five secondary hospitals; two of them perform pediatric appendectomies.

To evaluate the influence of quarantine on appendicitis we evaluated the percentage of appendicitis in the same period (March–April) from 2011. The study was approved by the internal review board. One of our objectives was to evaluate the eventual influence of the progressive opening in phase 2, during April.

During phase 1 people were confined at home without any possibility of staying outside (except for essential daily shopping). During phase 2, people were able to walk, run, and meet each other at a distance of 1.5 m. Children were restricted to their homes only during phase 1.

We evaluated the number and grade of appendicitis, gender, onset of symptoms and age at surgery. During the study period, appendicitis (cases versus urgencies) and their percentages during the month of March since 2011 were: 55% (12 appendicitis out of 22 urgencies), 47% (11 out of 23), 42% (10 out of 24), 32% (8 out of 25), 50% (13 out of 26), 30% (9 out of 30), 36% (10 out of 28), 44% (12 out of 27), 36% (7 out of 19), 10% (3 out of 29) in 2020 respectively; April appendicitis and percentages since 2011 were 44% (8 appendicitis out of 18 urgencies), 40% (7 out of 20), 40% (8 out of 20), 36% (10 out of 28), 40% (6 out of 15), 27% (5 out of 18), 35% (7 out of 19), 36% (11 out of 30), 32% (6 out of

## Emergent operation cases in the hospital: 461 cases / 172 appendicities



**Fig. 1** Distribution per years, cases between March and April. (■), Appendicitis case; (□), Others.

19), and 42% (9 out of 21) in 2020. There was a statistical significant difference regarding March 2020 and others. ( $P < 0.05$ ; Fig. 1).

Among study results it was interesting to note that the differences in percentage between months were stable during years, suggesting that seasonality is not a bias.

The percentage of appendicitis was stable during years that there were no cases, among hospitals, of appendicitis in patients having less than 9 years since half phase 2 (10 April). ( $P < 0.05$ ).

Regarding the onset of symptoms, there was a longer arrival to hospital in Secondary Hospital respect to Tertiary hospital; On multivariate analysis, secondary hospitals were associated with higher appendiceal perforation rates. Gender characteristics offer an interesting point of view, suggesting that even if, through the years, males are affected more than females, during phase 1 quarantine they were not statistically different ( $P > 0.05$ ).

During phase 1 of quarantine there was a general reduction in appendicitis, probably because the predisposing factors. More contacts between people, infections increased, with the highest differences through the years.

But, why were there less cases in phase 1? What is known is that untreated appendicitis will progress to perforation. So, there were less cases of appendicitis due to a reduced number of potential co-factors; these results could offer perspectives on different diseases during quarantine.

### Disclosure

The authors declare no conflict of interest.

### Author contributions

Z.N. designed the study. Z.N. and M.V. collected and analyzed the data. Z.N. and C.M. performed the analysis. Z.N. wrote the manuscript. C.F. gave conceptual advice. All authors read and approved the final manuscript.

### References

- 1 McCrum ML, Leroux B, Fang T. *et al.* Sex-based differences in transfusion need after severe injury: Findings of the PROPPR study. *Surgery* 2019; **165**: 1122–7.
- 2 Putnam LR, Tsao K, Nguyen HT *et al.* The impact of socioeconomic status on appendiceal perforation in pediatric appendicitis. *J. Pediatr.* 2016; **170**: 156–60.
- 3 Salö M, Ohlsson B, Arnbjörnsson E *et al.* Appendicitis in children from a gender perspective. *Pediatr. Surg. Int.* 2015; **31**: 845–53.
- 4 Akhtar-Danesh GG, Doumouras AG, Flageole H *et al.* Geographic and socioeconomic predictors of perforated appendicitis: A national Canadian cohort study. *J. Pediatr. Surg* 2019; **54**: 1804–8.
- 5 Sartelli M, Baiocchi GL, Di Saverio S. Prospective Observational Study On Acute Appendicitis Worldwide (POSAW). *World J. Emerg. Surg.* 2018; **16**: 13–19.