

Awareness of post-COVID-19 symptoms in children among medical students in Tikrit (Iraq)

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Medical students' knowledge of COVID-19 symptoms in children has been increasing since the World Health Organization declared the virus a pandemic. COVID-19 is an acute infectious respiratory disease.

The objective: to evaluate medical students' understanding of post-COVID-19 symptoms to raise awareness and help mitigate these symptoms in children.

Materials and methods. The cross-sectional study was conducted on 267 Iraqi undergraduate medical students at the University of Tikrit, using a questionnaire designed by the researchers. The collected data were analyzed using both statistical methods and Microsoft software.

Results. The study found that 104 (38.9%) out of 267 students were aware of post-COVID-19 symptoms in children, while 163 (61.1%) were not. Social media was the primary source of information, with 69 (66.35%) of the 104 aware students learning about the symptoms from it. The results were calculated among 104 students who declared awareness about post-COVID symptoms in general, and indicated that 47 (45.2%) students believed children experienced mild hypoxia post-COVID-19, and 44 (42.3%) thought children had mild anosmia. Additionally, 48 (46.17%) thought children had a slight cough, and 47 (45.2%) thought children experienced mild fatigue after COVID-19.

Conclusions. The study revealed gaps in knowledge, with many students unaware of potential post-COVID-19 symptoms such as heart problems, neurological issues, or multisystem inflammatory syndrome. The main source of information was social media, highlighting a need for improved education on post-COVID-19 symptoms in children.

Keywords: *post-COVID-19 symptoms, medical students, multisystem inflammatory syndrome and social media.*

Обізнаність студентів-медиків у Тікріті (Ірак) щодо симптомів пост-COVID-19 у дітей

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Обізнаність студентів-медиків щодо симптомів COVID-19 у дітей зростає з моменту оголошення Всесвітньою організацією охорони здоров'я про пандемію цього вірусу. COVID-19 – це гостре інфекційне респіраторне захворювання.

Мета дослідження: оцінити розуміння студентами-медиками симптомів пост-COVID-19, щоб підвищити обізнаність та допомогти полегшити ці симптоми в дітей.

Матеріали та методи. Перехресне дослідження було проведено за участю 267 іракських студентів-медиків в Університеті Тікріта за допомогою анкети, розробленої дослідниками. Зібрані дані проаналізовано за допомогою статистичних методів і програмного забезпечення Microsoft.

Результати. Дослідження продемонструвало, що 104 (38,9%) із 267 студентів знали про симптоми пост-COVID-19 у дітей, тоді як 163 (61,1%) – ні. Соціальні мережі були основним джерелом інформації, і 69 (66,35%) зі 104 обізнаних студентів дізналися про симптоми саме з них. Результати розраховували серед 104 студентів, які заявили про обізнаність щодо симптомів після COVID-19 загалом. Отримані результати показали: 47 (45,2%) студентів вважали, що діти переживають легку гіпоксію після COVID-19, а 44 (42,3%) – що у дітей є легка аносмія. Крім того, 48 (46,17%) студентів вважали, що у дітей є легкий кашель, а 47 (45,2%) – що діти переживають легку втому після COVID-19.

Висновки. Дослідження виявило прогалини в знаннях, оскільки багато студентів не знали про потенційні симптоми пост-COVID-19, як-от проблеми із серцем, неврологічні проблеми або мультисистемний запальний синдром. Основним джерелом інформації були соціальні мережі, що наголошувало на необхідності покращення освіти щодо симптомів після COVID-19 у дітей.

Ключові слова: *симптоми пост-COVID-19, студенти-медики, мультисистемний запальний синдром та соціальні мережі.*

Since the first case of COVID-19 was recognized in Wuhan, China in December 2019, the disease has been named coronavirus disease 2019 (COVID-19). This disease is caused by the novel coronavirus SARS-CoV-2 and is associated with significant injury and death on a global scale. Despite the majority of patients with COVID-19 having no symptoms or a mild to severe illness, 5–8% of them develop hypoxia, bilateral pulmonary infiltrates and decreased lung capacity, necessitating the use of NIV (Non-invasive ventilation) or mechanical ventilation,

respectively [1, 2]. Post-acute COVID-19 conditions are characterized by clinical symptoms that last longer than 4 weeks following the initial onset of acute symptoms. The U.S. Centers for Disease Control (CDC) states that “post-Covid conditions” are diseases that last over four weeks following the infection of COVID-19. These also include the persistent post-COVID syndrome (PPCS), which is sometimes referred to as long COVID. The effects of COVID-19 are felt across multiple organs, including the consequences of hospitalization and treatment [2, 3].

Distribution of responders by gender

Gender	Number	Percent
Male	90	33.33
Female	177	66.67
Total	267	100

NICE (National Institute for Health and Care Excellence) recommendations suggest the following categories: acute COVID-19 (symptoms that last up to four weeks), persistent symptomatic COVID-19 (symptoms that last four to twelve weeks), and post-COVID-19 (symptoms that appear following the infection and are longer than twelve weeks). The term “long COVID-19”, which is used in this guidance, refers to both the post-COVID-19 population and the symptomatic population that has continued to have COVID-19 [4]. Children may have a long symptomatology associated with COVID-19 that resembles the adult form, women are more likely to be affected. Fatigue, shortness of breath, headache, autonomic disorders, brain fog, loss of taste or smell, cough, depression, low temperature, palpitations, disorientation, muscle pain, and joint pain are all common symptoms of “long COVID-19”. Despite the duration of the effects of COVID-19 on multiple organs being unknown, they include symptoms that affect organs like the heart, lungs, kidneys, and brain [5, 6]. The majority of investigations of long-term COVID-19 have focused on adults. The younger age group has less data, as investigations involving minors are more time-consuming in obtaining ethical approval. The first investigation of long-term COVID-19 in children revealed that 42% of the 6–16-year-olds who were infected with the virus were unable to complete daily tasks due to at least one symptom that was longer than 120 days [7, 8]. The information regarding the clinical effects of COVID-19 in children is lacking, specifically in regard to those with mild or silent disease [9].

The objective was to evaluate the medical students' knowledge of the symptoms of children following COVID-19.

MATERIALS AND METHODS

Study design and samples

As part of an epidemiological inquiry and cross-sectional study design, medical students' awareness of post-COVID-19 symptoms in children was assessed between January 2024, and January 2025, using an original questionnaire, developed by researchers. The English-language survey was completed and gathered at the University of Tikrit's College of Medicine. Simple random sampling was the sample strategy used in the study. A statistical analysis that was done by hand was used to determine the sample size. The overall number of polled students was 267; however, the study results about students' knowledge about particular post-COVID-19 symptoms was deliberately confined to the subgroup of 104 students (38.9%) who reported prior awareness of the post-COVID-19 conditions in children. The justification for concentrating on this subgroup is that significant insights concerning symptom recognition and intensity may only be evaluated in those who at least knows about disease. Incorporating comments from students lacking prior awareness of post-COVID-19 symptoms would undermine the accuracy, relevance, and interpretability of the findings. The decision to analyze this subset guarantees that the outcomes represent genuine knowledge rather than conjectures or estimates.

Statistical analysis

Statistical analysis was performed by manual statistical methods included measurement of the number and

percent data presented by using tables figures in Microsoft programs (Word and Excel).

Ethical approval

Ethical committee at the Department of Community Medicine, University of Tikrit, College of Medicine, granted ethical approval for the study protocol, questions, and consent statement in accordance with the principles of the Declaration of Helsinki.

RESULTS AND DISCUSSION

Table 1 demonstrates demographic characteristics of the interweaves and shows that 90 (33.33%) of the 267 medical students were male, while 177 (66.67%) were female.

Table 2 indicates that 163 (61.1%) of 267 (100%) responders were not aware of post-COVID-19 symptoms in children, while 104 (38.9%) were aware. This data suggests that medical students do not fully comprehend the symptoms that children experience after COVID-19.

This focused methodology was implemented to ensure data quality, as only participants with pre-existing awareness of post-COVID-19 conditions could provide clinically relevant observations about symptom patterns. The selection criteria effectively filtered out noise from uninformed responses, creating a robust dataset for analyzing authentic recognition and severity assessment of pediatric post-COVID manifestations. Such rigorous participant screening enhances the validity of conclusions about healthcare students' competency in identifying these specialized clinical presentations.

There is a paucity of awareness about post-COVID-19 symptoms in children among medical students, as shown in Fig. 1; 104 students (38.9% of the total) reported having prior information on this topic, while 163 students (61.1%) did not. Among the 104 medical students who took part in the survey, 9 (8.56%) thought that children do not experience any fatigue after COVID-19, 32 (30.77%) thought that children experience mild fatigue, 47 (45.2%) thought that children experience moderate fatigue, and 16 (15.38%) thought that children have severe exhaustion.

Among 104 responders, 29 (or 27.9%) thought that children showed no gastrointestinal symptoms after contracting COVID-19. Another 35 (33.6%) thought that the symptoms were mild, 33 (31.73%) – moderate, and 7 (6.72%) – severe. Thanks to social media, 66.35% of the total 104 medical students were familiar with the symptoms that children could experience after contracting the COVID-19 virus. No one has read any books or publications to learn about the topic. Fig. 2 also shows that 23 people, or 22.11% of the total, have searched for information online, while 12 people, or 11.54% of the total, had medical advice.

Awareness, symptomatology, and management of post-COVID-19 symptoms in children

Categories		Number	Percent
Do you hear about post-COVID-19 symptoms	Yes	104	38.9
	No	163	61.1
	Total	267	100
Duration of post-COVID-19 symptoms in children	Short	87	83.65
	Long	17	16.35
	Total	104	100
Treatment of post-COVID-19 symptoms in children	Simple	84	80.76
	Complex	20	19.76
	Total	104	100
Sources of post-COVID-19 symptoms in children	Social media	69	66.35
	Magazines and books	0	0
	Internet	23	22.11
	Doctors	12	11.54
	Total	104	100
Hypoxia	No	30	28.85
	Mild	47	45.2
	Moderate	19	18.3
	Sever	8	7.65
	Total	104	100
Anosmia	No	29	27.9
	Mild	44	42.3
	Moderate	26	25
	Sever	5	4.8
	Total	104	100
Cough	No	15	14.415
	Mild	48	46.17
	Moderate	26	25
	Sever	15	14.415
	Total	104	100
Fatigue	No	9	8.56
	Mild	32	30.77
	Moderate	47	45.2
	Sever	16	15.38
	Total	104	100
Gastrointestinal tract (GIT) symptoms	No	29	27.9
	Mild	35	33.65
	Moderate	33	31.73
	Sever	7	6.72
	Total	104	100
Neurological symptoms	No	57	54.8
	Mild	30	28.85
	Moderate	14	13.46
	Sever	3	2.89
	Total	104	100

Categories		Number	Percent
Cardiac symptoms	No	57	54.8
	Mild	34	28.85
	Moderate	11	13.46
	Sever	3	2.89
	Total	104	100
Feeling weak or dizzy	No	18	17.3
	Mild	36	34.61
	Moderate	33	31.73
	Sever	17	16.36
	Total	104	100
Rash (red spots blotches)	No	67	64.42
	Mild	24	23.07
	Moderate	11	10.57
	Sever	2	1.94
	Total	104	100
Multisystem inflammatory syndrome in children	No	56	53.85
	Mild	31	29.8
	Moderate	17	16.35
	Sever	0	0
	Total	104	100
Toxic shock syndrome	No	65	62.5
	Mild	32	30.72
	Moderate	7	6.73
	Sever	0	0
	Total	104	100

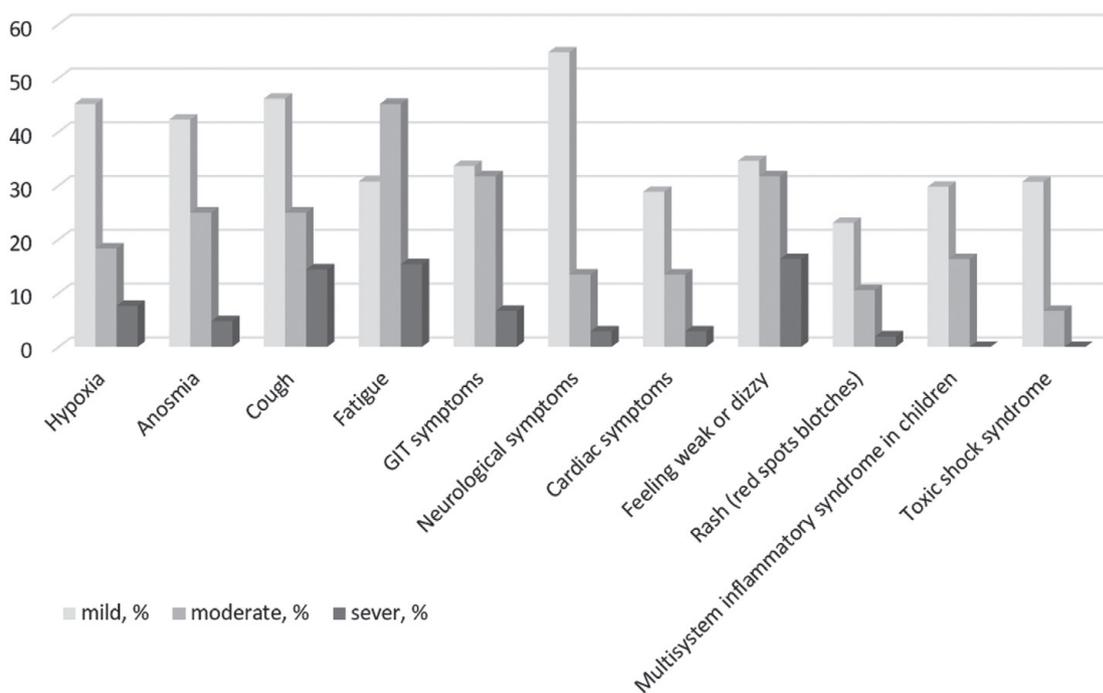


Fig. 1. Finding of post-COVID-19 symptoms in children, %

Note: GIT – gastrointestinal tract.

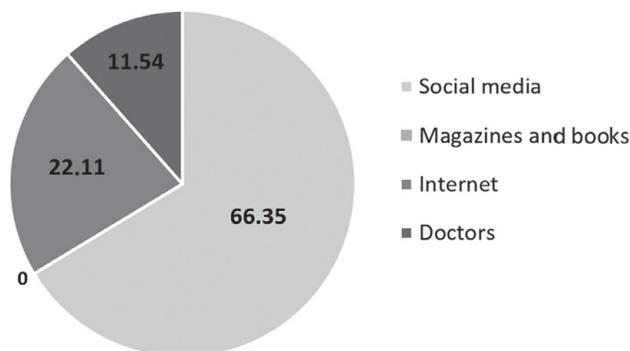


Fig. 2. Sources of data for children's post-COVID-19 symptoms, %

Recent studies have shown that the main symptoms of post-COVID-19 syndrome in children are comparable to those previously documented in adults. According to the current study, 61.1% of medical students did not know what COVID-19 symptoms were. This is a noteworthy figure, indicating that many medical students do not fully comprehend the issue [10–12]. Post-COVID-19 syndrome is not limited to individuals who had severe acute COVID-19. According to the published data, the most prevalent persistent symptoms among 83 patients studied, were chest pain (9.6%) with an average duration of 20.8 weeks, headache (13.2%) with an average duration of 16.7 weeks, cough (15.6%) with an average duration of 17.4 weeks, taste impairment (18.1%) with an average duration of 19.86 weeks, fatigue (44.6%) with an average duration of 17.35 weeks, and dyspnea (24.1%) with an average duration of 17.9 weeks [13–15]. It is clear that the students' comprehension about these prolonged symptoms is inadequate, since 83.65% of the medical students who took part in the current study said that the duration of post-COVID-19 syndrome is short [16–18].

There are no recognized markers for post-COVID-19 syndrome, and symptoms are often mild and become better with time. Given that 80.76% of medical students in our study said that the treatment is simple, this is in

line with their comments [19, 20]. Unfortunately, despite the fact that social media is still untrustworthy and includes a lot of false material, the majority of students (66.35%) who took part in our poll relied on it as their source of information [21, 22].

Finally, there is a wide range of post-COVID-19 effects, most of which are mild and controllable. Although the acute phase of COVID-19 infection is often followed by a variety of neurological and cardiac symptoms, 54.8% of survey respondents stated that children after acute phase had no neurological symptoms, and the same percentage indicated they had no cardiac symptoms. Nonetheless, a significant portion of students suggested a moderate severity rating to the symptoms. For instance, even though gastrointestinal tract (GIT) symptoms are usually minor and controllable, 45.2% of participants assessed tiredness as moderate, and 33.6% of people rated GIT symptoms as moderate. This indicates that medical students do not fully comprehend whether children have post-COVID-19 symptoms, let alone how severe they can be [23–25].

CONCLUSIONS

The findings indicated that although fatigue, cough, and anosmia were often acknowledged symptoms, more severe consequences, including neurological and cardiac symptoms, along with multisystem inflammatory syndrome, were insufficiently recognized. Social media served as the predominant source of information, signifying an over dependence on potentially untrustworthy channels.

The results indicate a pressing necessity for improvements in medical education curricula, especially concerning the long-term pediatric consequences of COVID-19. Enhancing formal education on post-COVID-19 disorders may better equip future physicians to accurately recognize and manage these consequences in children.

Authors' contributions. Sample collection, sample analysis, data collection, statistical analysis, manuscript writing, conceptualization of the research, design, and manuscript proofreading were done by all authors.

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