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**Post-COVID Syndrome in Children: One-Time Survey Study of Parents Opinion**

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**Received:** 07.12.2022, **accepted for publication:** 22.06.2023

***Background.*** *COVID-19 symptoms often persist for a long time, it indicates the post-COVID syndrome development. Its frequency in children population is generally studied by interviewing the children themselves. This approach limits the risk evaluation of post-COVID syndrome development in young children who are unable to describe the persistent symptoms due to their age.* ***Objective. The aim of the study is to*** *evaluate the prevalence of post-COVID syndrome in children and its effect on their daily activities by interviewing parents.* ***Methods.*** *The survey covered parents of children (aged from 3 months to 18 years) who underwent laboratory-confirmed COVID-19 in 2021-2022 but not earlier than 12 weeks before study initiation. The survey was conducted remotely. The presence of the symptoms (persisted or occurred 12 after COVID-19), its impact on children daily life, the need for medical treatment or doctor's advice (due to these symptoms) and for vaccination against novel coronavirus infection were evaluated. Incidence of post-COVID syndrome was specified in subgroups based on sex, age (<3 years, 3-6 and 7-17 years), and disease severity.* ***Results.*** *Invitations to participate in the study were sent to 2292 parents of all children who have undergone COVID-19, 1533 (66.9%) of them took part in the survey, and 1258 (54,8%) filled out the questionnaire completely. The survey has revealed that at least one symptom that persisted or occurred 12 weeks after COVID-19 was noted by parents in 764 out of 1258 (60.6%) children (more often in the older age group and in severe cases). Significant negative impact of symptoms on children daily life was noted by 251 out of 764 (32.9%) respondents. Parents of 734 out of 764 (96.1%) children have visited a doctor due to post-COVID syndrome symptoms.* ***Conclusion.*** *Post-COVID syndrome develops in more than 60% of children after laboratory-confirmed COVID-19, according to parents. However, we have reasons to believe that parental estimations could overestimate the prevalence of post-COVID syndrome.*

***Keywords:*** *post-COVID syndrome, children, parents, COVID-19, SARS-CoV-2*

***For citation:*** Shagieva Dilara R., Kutlubaev Mansur A., Rakhmatullin Airat R. Post-COVID Syndrome in Children: One-Time Survey Study of Parents. *Voprosy sovremennoi pediatrii — Current Pediatrics*. 2023;22(3):XX–XX. doi: https://doi.org/10.15690/vsp.v22i3.2582

**Table 1.** Characteristics of children who have undergone COVID-19

|  |  |
| --- | --- |
| **Indicatoy** | **Frequency (*n* = 1258)** |
| Gender (male), abs. (%) | 689 (54,8) |
| Age, abs. (%):* < 3 years
* 3–6 years
* 7–17 years
 | 207 (16,5)230 (18,3)821 (65,3) |
| COVID-19 severity, abs. (%):* asymptomatic
* mild
* moderate
* severe
 | 142 (11,3)935 (74,3)168 (13,4)13 (1,0) |
| Presence of comorbidities, abs. (%) | 483 (38,4) |
| Vaccination against COVID-19, abs. (%) | 19/475 (4,0)\* |

*Note.* <\*> — calculated from the number of children aged ≥12 years.

**Table 2.** Symptoms that persisted or occurred in children 12 weeks after COVID-19 (*n* = 1258)

|  |  |
| --- | --- |
| **Complaints** | **Frequency, abs. (%)** |
| Rapid fatigue after exercise | 315 (25,0) |
| Irritation | 213 (16,9) |
| Fatigue feeling, general weakness | 207 (16,5) |
| Headaches | 188 (14,9) |
| Rashes | 162 (12,9) |
| Sleep disorders | 157 (12,5) |
| Digestive disorders\* | 143 (11,4) |
| Poor appetite | 141 (11,2) |
| Arthralgia and myalgia | 111 (8,8) |
| Hair loss | 109 (8,7) |
| Memory impairment | 108 (8,6) |
| Compulsory movements\*\* | 88 (7,0) |
| Sense of smell and taste disorders | 70 (5,6) |
| Dizziness | 68 (5,4) |
| Chronic cough | 58 (4,5) |
| Weight loss | 52 (4,1) |
| Heart failure | 37 (2,9) |
| Dyspnea | 26 (2,1) |
| Chest pain | 22 (1,7) |
| Idiopathic fever | 6 (0,5) |

*Note.* <\*> diarrhea, constipation, bloating, burping, heartburn; <\*\*> child tousles clothes, hair, licks lips, gnaw fingers, sucks finger, blinks often, stutters.

**Table 3.** Subspecialists visits in children with symptoms persisted or occurred 12 weeks after COVID-19 (*n* = 764)

|  |  |
| --- | --- |
| **Speciality** | **Frequency, abs. (%)** |
| Neurologist | 239 (31,3) |
| ENT specialist | 178 (23,3) |
| Gastroenterologist | 129 (16,9) |
| Allergologist | 91 (11,9) |
| Endocrinologist | 63 (8,2) |
| Orthopedist | 58 (7,6) |
| Immunologist | 42 (5,5) |
| Surgeon  | 36 (4,7) |
| Psychologist | 27 (3,5) |
| Pulmonologist | 17 (2,2) |
| Psychiatrist | 16 (2,1) |
| Other specialists | 266 (34,8) |

**RESEARCH LIMITATIONS**

On the one hand, the advantage, and on the other, the limitation of this study is the use of parental opinions to assess the frequency of symptoms in children. They could not accurately determine the presence (or absence) of any subjective signs of previous illness in their child [12]. Inclusion of infants' parents in the study reduces the reliability of of assessing the post-COVID syndrome presence. Obviously, the child cannot express the full range of his health-related experiences at this age. However, the proportion of children under the age of 3 years old in the sample was only 16.5%. Moreover, nowadays there are no other methods applicable for mass evaluation of symptoms presence in children of this age, except for parents interviewing; objectification of their symptoms is the subject of future studies.

The study had no control group, it could lead to overestimation of the post-COVID syndrome prevalence as the symptoms from the questionnaire could occur both in healthy children and in children with various chronic diseases not related to COVID-19. For example, the national Danish study has shown that the frequency of symptoms in children of the younger age group without COVID-19 in anamnesis was higher than in those who underwent COVID-19, otherwise, in the older age group this indicator was comparable in these children [14]. It should also be noted that the frequency analysis of symptoms in subgroups formed by gender, age and COVID-19 severity could give false-positive (at p<0.05) results due to the large number of comparisons.

The study did not assess the exact time of symptoms onset since COVID-19 diagnosis. This can be important since some symptoms of COVID-19 resolve over time (such as hyposmia) [3], while others aggravate (affective disorders). Probably every disease period has its own "typical" symptoms [2, 3]. It should also be noted that this study used slightly different term of "post-COVID syndrome" (compared to approved definition) [2]. Particularly, parents were asked about symptoms that "persist/occurred 3 months after the new coronavirus infection (COVID-19)" while approved definition [2] refers to symptoms that persist (at least) during this period. It should also be note that the syndrome is a combination of two or more symptoms with a general etiology according to the generally accepted definition [18], while according to the mentioned expert consensus one symptom is enough to diagnosis post-COVID syndrome. Thus, it will be more correct to use the term "post-COVID condition" instead of the term "post-COVID syndrome".

Online questionnaire is low-cost and quick method for data collection from large groups of people who have Internet access [19]. It is comfortable for respondents as it does not require a visit to medical facility. Its disadvantages include lack of Internet access and low computer skills in the population with low socio-economic status [20]. Moreover, the absence of direct contact with respondents does not allow them to clarify the questions or ask for additional information, if needed [19].

**FINANCING SOURCE**

This work was supported by the Bashkir State Medical University Strategic Academic Leadership Program (PRIORITY-2030).

**DISCLOSURE OF INTEREST**

Not declared.