

Research Article

Analysis of Clinical Characteristics in Children and Adult Patients with Influenza A and B

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Abstract

Background. Seasonal influenza of each year with different severity can cause a high infection rate and death rate over the world. Few studies about the comparison of the clinical characteristics between children and adult patients with influenza A and B from China were reported. **Objective.** Aimed to provide the data of differences in clinical characteristics for influenza infected children and adults. **Methods.** Baseline characteristics were collected and analyzed. Chi-square test was used to analyze categorical variables in patients with influenza. **Results.** 1663 influenza cases were included, no significant difference was observed in the gender ratio of children between influenza A and B group ($P > 0.05$), while less adult male were infected with influenza B ($P = 0.038$). Children with influenza B showed more occurring frequency in bronchitis and pneumonia when compared to children with influenza A ($P < 0.05$). Most children had fever and laryngopharyngitis both occurred over 60.8% in influenza A and B group. While fever is the most occurred symptom among adult patients both in influenza A group and influenza B group with a proportion of 80.4% and 74.7% respectively. **Conclusions.** Fever was the most occurred symptoms in children and adult patients with influenza. Children with influenza are more susceptible to occur lower respiratory tract infection (bronchitis and pneumonia) than adult patients did.

Keywords

Influenza, Children, Adults, Clinical Symptom

1. Introduction

Seasonal influenza of each year with different severity can cause a high infection rate and death rate over the world [1-3]. Although the influenza infection belongs to the type of

self-limiting diseases, and in most cases the patients can restore health without any risk of occurring other serious complications [4, 5], it is an important disease that affects many

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people and causes severe symptoms in some patients [6], for example, pneumonia, hemorrhagic bronchitis, and even acute respiratory distress syndrome. Influenza is one of the most common reasons of acute respiratory diseases and taking sick leave from school for children. Furthermore, in the childhood encephalitis studies, cases from influenza infected children takes part in a proportion of 2-11%. For old people, and those with certain underlying diseases, it also has a higher risk of complications, and even otherwise healthy adults in some cases also require intensive care because of the severe influenza infection [7].

Although a wealth of data relevant to differences between children and adult patients with influenza is available. Previous research report that children may also be considered as the main source of influenza transmitting over the community [8, 9]. Besides, it is reported that children with influenza showed a higher viral titers and a longer period of shed virus than that of adults [10]. Reports from surveillance programs basing on community have showed that the children are more likely to be infected by H1N1 subtype and influenza B viruses, while adults are more likely to be infected by H3N2 subtype [11]. But few studies about the comparison of the clinical characteristics between children and adult patients with influenza A and B from China were reported.

In this study, we aimed to present the data of differences in clinical characteristics for influenza infected children and adults from Guangdong Second Provincial General Hospital in China over eight influenza seasons (2016–2023).

2. Materials and Methods

2.1. Patients and Inclusion Criteria

A total of 572 children and 1091 adults confirmed influenza in Guangdong Second Provincial General Hospital from January 1, 2016, to December 31, 2023 were included in this research, and the patients must be first-visit outpatients for this influenza episode. The laboratory test (immunocolloidal gold method) was used to test the influenza virus antigens from the respiratory specimens, and positive results were considered as influenza A or B cases occurring, the immunocolloidal gold method shows a very high specificities (>98%) [12, 13]. But those combining with other infections or having undergone antiviral therapy were not included.

2.2. Data Collection

Clinical data including demographic, characteristics, and chest X-ray of each patient were collected from hospital computer database system and patients' medical records.

2.3. Statistical Analyses

IBM SPSS Statistics 17.0 was used to analyze all data, and the quantitative data is expressed as median \pm SD. Multiple groups were compared by one-way ANOVA, two independent groups were compared by independent sample t-test, and chi-square test was used to analyze categorical variables. All tests were two-sided, a $P < .05$ was considered statistically significant.

3. Results

3.1. Baseline Characteristics of Children with Influenza

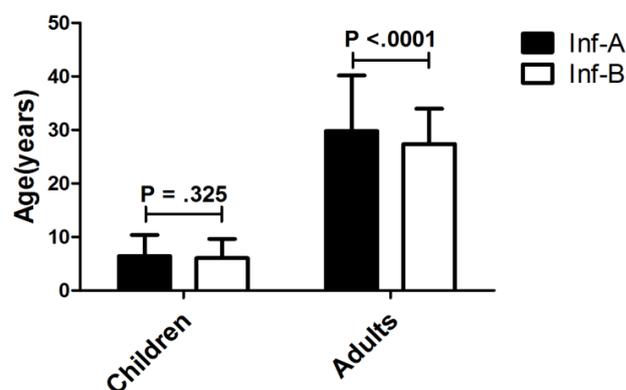


Figure 1. Comparison of age for patients with influenza A and influenza B infection. Error bars indicate the mean and standard deviation of age of influenza A group and influenza B group for children and adult patients. Inf: Influenza.

572 influenza infected children were enrolled in this research, including 148 children with influenza B and 424 children with influenza A. The mean age was slightly higher among children with influenza A comparing to children with influenza B, although the difference was not statistical ($P = 0.325$) (Figure 1). And it did not show a significant difference in the gender ratio between the two groups ($P = 0.706$) (Figure 2A). Table 1 shows the clinical symptoms of influenza infected children at presentation. Most children had fever and laryngopharyngitis both occurred over 60.8% in influenza A and B group. Gastroenteritis and cough in influenza A children occurred as frequently as in influenza B children without a significant difference ($P > 0.05$). Bronchitis occurred more frequently among influenza B virus infected children than influenza A virus infected children ($P < 0.0001$), and other clinical symptoms of influenza were more common in influenza A infected children ($P = 0.003$). Amygdalitis was documented in 4.7% of the children with influenza B, which was slightly higher than that of children with influenza B, however, it did not show a significant difference between the two ($P = 0.075$). In addition, more cases developed pneumonia among

influenza B infected children than influenza A infected children ($P = 0.041$) (Table 1).

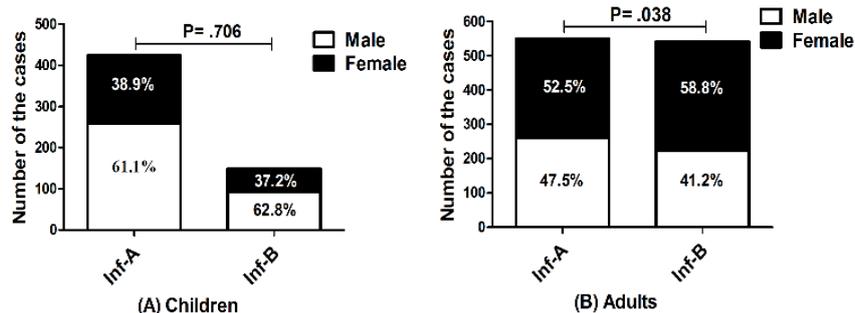


Figure 2. Comparison of sex ratios of influenza A and influenza B in children group (A) and adult patients group (B). Inf: Influenza.

3.2. Baseline Characteristics of Adult Patients with Influenza

A total number of 1153 influenza patients were included in this research, including 550 influenza A adult patients and 541 influenza B adult patients. Similar to the influenza positive children, the mean age was significantly lower among patients with influenza B (27.4 years) than those with influenza A (29.8 years) in adult patients with a significance of $P < 0.0001$ (Figure 1). Unlike to the sex ratio of children with influenza A and B, it showed a significant difference in the sex ratio of adult patients between the influenza A and B groups, less adult male was infected by influenza B virus ($P = 0.038$) (Figure 2B). Table 2 shows the clinical symptoms of influenza infected adults at presentation. Fever is the most occurred symptom among adult patients both in influenza A group and influenza B group with a proportion of 80.4% and 74.7% respectively, and there was a significant difference between the two groups ($P = 0.024$). Other influenza symptoms and laryngopharyngitis occurred more frequently among influenza A adults than influenza B adults ($P = 0.023$, and 0.021 respectively), while cough was more common in adult patients with influenza B ($P = 0.007$). However, gastroenteritis,

bronchitis, amygdalitis, and pneumonia in influenza A positive adults occurred as frequently as in influenza B positive adults with a very low rate of no more than 3% ($P > 0.05$) (Table 2).

3.3. Comparison of Clinical Symptoms Between Children and Adult Patients

Among patients with influenza A, laryngopharyngitis, bronchitis, cough, gastroenteritis, other influenza symptoms and pneumonia occurred less frequently among adults than children with a significance of $P < 0.0001$. While there were no significant differences in fever and amygdalitis between children and adult patients ($P = 0.334$, and 0.182 respectively) (Table 3, Figure 3). Of influenza B positive patients, the proportion of laryngopharyngitis, bronchitis, gastroenteritis, other influenza symptoms, amygdalitis, and pneumonia were significantly higher in children than those of adults ($P < 0.05$). However, no differences were found in fever and cough when comparing children versus adults infected influenza B ($P > 0.05$) (Table 4, Figure 4). Interestingly, independently of the influenza virus and age, fever was the most occurred symptoms, and there was no significant difference among the four groups ($P > 0.05$) (Tables 3 and 4, Figures 3 and 4).

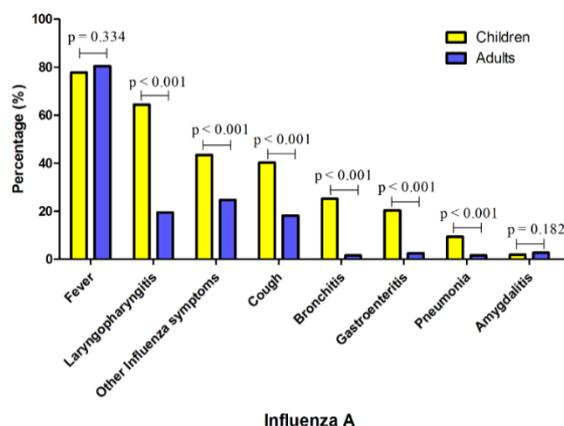


Figure 3. Bar chart of clinical symptoms for children and adult patients with influenza A.

Table 1. Baseline children with influenza A and B.

Clinical symptoms	Influenza A (n = 424)	Influenza B (n = 148)	X ²	P value
Laryngopharyngitis, no. (%)	273(64.4)	96(64.9)	0.011	0.917
Fever, no. (%)	330(77.8)	106(71.6)	2.33	0.127
Bronchitis, no. (%)	107(25.2)	60(40.5)	12.43	<0.0001
Cough, no. (%)	171(40.3)	48(32.4)	0.003	0.956
Gastroenteritis, no. (%)	86(20.3)	30(20.3)	0	0.997
Other influenza symptoms, no. (%)	184(43.4)	44(29.7)	8.548	0.003
Amygdalitis, no. (%)	8(1.9)	7(4.7)	-	0.075
Pneumonia	40(9.4)	23(15.5)	4.174	0.041

X²: comparison of categorical variables.

Table 2. Baseline adults with influenza A and B.

Clinical symptoms	Influenza A (n = 550)	Influenza B (n = 541)	X ²	P value
Laryngopharyngitis, no. (%)	107(19.5)	77(14.2)	5.304	0.021
Fever, no. (%)	442(80.4)	404(74.7)	6.824	0.024
Bronchitis, no. (%)	9(1.6)	4(0.7)	1.864	0.172
Cough, no. (%)	100(18.2)	135(25.0)	7.401	0.007
Gastroenteritis, no. (%)	14(2.5)	16(3.0)	0.173	0.677
Other influenza symptoms, no. (%)	136(24.7)	103(19.0)	5.159	0.023
Amygdalitis, no. (%)	15(2.7)	9(1.7)	1.434	0.231
Pneumonia, no. (%)	9(1.6)	6(1.1)	0.559	0.455

X²: comparison of categorical variables.

Table 3. Baseline children and adults with influenza A.

Clinical symptoms	Children (n = 424)	Adults (n = 550)	X ²	P value
Laryngopharyngitis, no. (%)	273(64.4)	107(19.5)	203.2	<0.0001
Fever, no. (%)	330(77.8)	442(80.4)	0.935	0.334
Bronchitis, no. (%)	107(25.2)	9(1.6)	127.1	<0.0001
Cough, no. (%)	171(40.3)	100(18.2)	58.5	<0.0001
Gastroenteritis, no. (%)	86(20.3)	14(2.5)	81.8	<0.0001
Other influenza symptoms, no. (%)	184(43.4)	136(24.7)	37.9	<0.0001
Amygdalitis, no. (%)	8(1.9)	15(2.7)	1.783	0.182
Pneumonia, no. (%)	40(9.4)	9(1.6)	30.5	<0.0001

X²: comparison of categorical variables

Table 4. Baseline children and adults with influenza B.

Clinical symptoms	Children (n = 148)	Adults (n = 541)	X ²	P value
Laryngopharyngitis, no. (%)	96(64.9)	77(14.2)	37.9	<0.0001
Fever, no. (%)	106(71.6)	404(74.7)	0.564	0.453
Bronchitis, no. (%)	60(40.5)	4(0.7)	218.5	<0.0001
Cough, no. (%)	48(32.4)	135(25.0)	3.332	0.068
Gastroenteritis, no. (%)	30(20.3)	16(3.0)	55.9	<0.0001
Other influenza symptoms, no. (%)	44(29.7)	103(19.0)	7.914	0.005
Amygdalitis, no. (%)	7(4.7)	9(1.7)	4.816	0.028
Pneumonia, no. (%)	23(15.5)	6(1.1)	60.0	<0.0001

X²: comparison of categorical variables

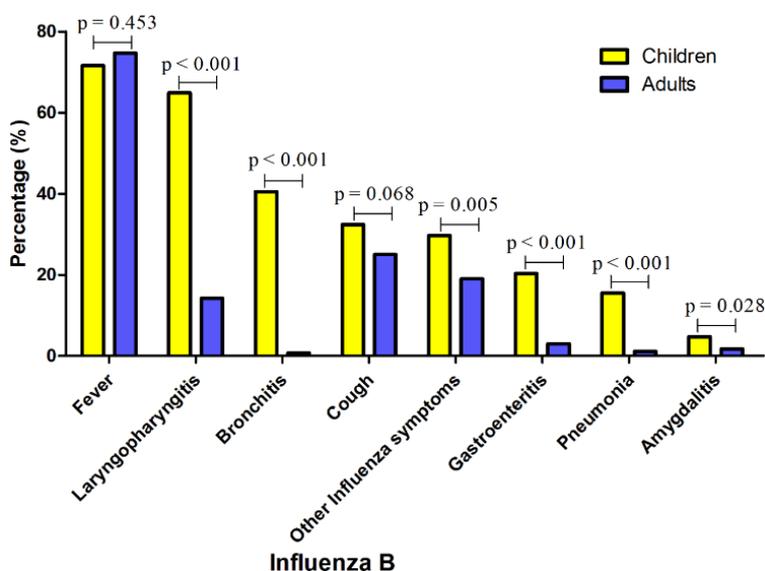


Figure 4. Bar chart of clinical symptoms for children and adult patients with influenza B.

4. Discussion

During the winter season, influenza is one of the most common reasons of acute upper respiratory tract infections. It is extremely contagious, such that all people especially children and old people are susceptible. It not only can cause acute respiratory distress syndrome, but also multiple organ dysfunction, and even death in the severe cases [14]. During 8 influenza seasons (2016-2023), we collected 974 patients with influenza A and 689 patients with influenza B, influenza A showed a much higher prevalence rate than influenza B, it was consistent with other studies which reported that influenza B virus had less ability to cause pandemics than influenza A virus [15].

We analyzed the clinical characteristics of 572 children and 1091 adults with influenza, most children had respiratory

symptoms such as laryngopharyngitis, fever, cough and bronchitis, as well as non-respiratory symptoms such as gastroenteritis. Among them, fever and laryngopharyngitis were the two most common symptoms. A retrospective analysis of the clinical characteristics of 133 children with influenza in the Italian by Mancinelli et al [16] has shown that fever, bronchitis and bronchiolitis are the main clinical manifestations of children with influenza, and fever was the most common clinical symptom in influenza positive patients. Tran et al [17] have conducted a large-scale research and reported that the most common symptoms of children with influenza are fever (92.9% in influenza A and 93.5% in influenza B), and cough (85.7% in influenza A and 84.2% in influenza B), however, the above research findings are still some different with those from this study that laryngopharyngitis and fever were the most two common symptoms in influenza positive

children, and this may be due to the regional difference. Being very different from the performance of children, influenza positive adult patients showed a much higher proportion in the symptoms of fever comparing to other symptoms (including cough, gastroenteritis, bronchitis, and so on) (Tables 3 and 4, Figures 3 and 4). The different performance in clinical manifestations between these two groups of people may be due to the differences in immunity between children and adults [18, 19]. Additionally, the differences in viral shedding patterns by age [20, 21] also may be one of the reason, however, the exact reason is uncertain and need further study.

Furthermore, our research findings on adult patients were not completely consistent with previous research reports that high fever and cough are the most common symptoms occurring in 60% - 80% of cases, the rate of cough in the present study was only 18.2% and 25.0% in adult patients with influenza A and influenza B respectively. This may be due to the regional difference. According to report from other research group that fever might not be present in many people who are symptomatic, particularly in older adults and people who are immunocompromised [22]. However, the result of the current study is slightly different that fever was the most common symptom in influenza virus positive adult patients, and was much higher than that of other symptoms (Tables 3 and 4, Figures 3 and 4). One reason for this inconsistency may be the much younger mean age of the subjects in this study. The mean ages were only 29.8 years for adult patients with influenza A and 27.4 years for adult patients with influenza B. The study results from other research groups also showed that elderly patients with COVID-19 may not show the typical symptoms of pulmonary infections such as fever, chest pain, and cough as younger people do [23, 24]. Moreover, our results showed that influenza virus infected children are more likely to occur bronchitis and pneumonia than adult patients did ($P < 0.0001$). The reason is uncertain and require further study.

5. Conclusions

In conclusion, less adult male was infected with influenza B, fever was the most occurred symptoms in children and adult patients with influenza. However, there are still several differences in clinical symptoms for these two populations. Children with influenza are more likely to develop lower respiratory tract infection comparing to adults, and children with influenza B had more bronchitis and pneumonia than those of children with influenza A. This study provides data on the differences between the manifestations of influenza in children and adults. The findings of this study could help clinician improve their clinical management of influenza in clinical practice.

Abbreviations

Inf Influenza

Inf-A Influenza-A
 Inf-B Influenza-B
 SD Standard Deviation
 COVID-19 Coronavirus Disease 2019

Author Contributions

Seyin Zou: Conceptualization, Investigation, and Methodology

Siti Hasmah Mohtar: Conceptualization, Supervision, Project administration

Roshani Othman: Supervision

Rodiah Mohd Hassan: Supervision

Kun Liang: Data curation, Software

Shuyao Xu: Data curation, Software

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Gil-de-Miguel Á., Díez-Domingo J., Martín-Torres F., et al. Addressing influenza's underestimated burden - Iberian experts call to action. *BMC Infect Dis.* 2023, 23(1): 308-312. <https://doi.org/10.1186/s12879-023-08277-x>
- [2] Conrad A., Valour F., Vanhems P. Burden of influenza in the elderly: a narrative review. *Curr Opin Infect Dis.* 2023, 36(4): 296-302. <https://doi.org/10.1097/QCO.0000000000000931>
- [3] Cavallazzi R., Ramirez J. A. Influenza and Viral Pneumonia. *Infect Dis Clin North Am.* 2024, 38(1): 183-212. <https://doi.org/10.1016/j.idc.2023.12.010>
- [4] Mauskopf J., Klesse M., Lee S., et al. The burden of influenza complications in different high-risk groups: a targeted literature review. *J Med Econ.* 2013, 16(2): 264-277. <https://doi.org/10.3111/13696998.2012.752376>
- [5] Ghebrehewet S., MacPherson P., Ho A. Influenza. *BMJ.* 2016, 355: i6258. <https://doi.org/10.1136/bmj.i6258>
- [6] Wang G. F., Li W., Li K. Acute encephalopathy and encephalitis caused by influenza virus infection. *Curr Opin Neurol.* 2010, 23: 305-311. <https://doi.org/10.1097/wco.0b013e328338f6c9>

- [7] Bautista E., Chotpitayasunondh T., Gao Z., et al. Clinical aspects of pandemic 2009 influenza A (H1N1) virus infection. *New Engl J Med.* 2010, 362: 1708-1719. <https://doi.org/10.1056/NEJMra1000449>
- [8] Goenka A., Michael B. D., Ledger E., et al. Neurological manifestations of influenza infection in children and adults: results of a National British Surveillance Study. *Clin Infect Dis.* 2014, 58: 775-784. <https://doi.org/10.1093/cid/cit922>
- [9] Britton P. N., Blyth C. C., Macartney K., et al. The Spectrum and burden of influenza-associated neurological disease in children: combined encephalitis and influenza sentinel site surveillance from Australia, 2013-2015. *Clin Infect Dis Off Publ Infect Dis Soc Am.* 2017, 65: 653-660. <https://doi.org/10.1093/cid/cix412>
- [10] Fujimoto S., Kobayashi M., Uemura O., et al. PCR on cerebrospinal fluid to show influenza-associated acute encephalopathy or encephalitis. *Lancet Lond Engl.* 1998, 352: 873-875. [https://doi.org/10.1016/S0140-6736\(98\)12449-2](https://doi.org/10.1016/S0140-6736(98)12449-2)
- [11] Okuno H., Yahata Y., Tanaka-Taya K., et al. Characteristics and outcomes of influenza-associated encephalopathy cases among children and adults in Japan, 2010-2015. *Clin Infect Dis.* 2018, 66: 1831-1837. <https://doi.org/10.1093/cid/cix1126>
- [12] Merckx J., Wali R., Schiller I., et al. Diagnostic accuracy of novel and traditional rapid tests for influenza infection compared with reverse transcriptase polymerase chain reaction: a systematic review and meta-analysis. *Ann Intern Med.* 2017, 167: 394-409. <https://doi.org/10.7326/M17-0848>
- [13] Timothy M., Uyeki H. H., Bernstein J. S., et al. Clinical Practice Guidelines by the Infectious Diseases Society of America: 2018 Update on Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management of Seasonal Influenza. *Clinical Infectious Diseases.* 2019, 68: 895-902. <https://doi.org/10.1093/cid/ciy874>
- [14] Bramley M., Bresee J., Finelli L.. Pediatric influenza. *Pediatr Nurs.* 2009, 35: 335- 345. <https://pubmed.ncbi.nlm.nih.gov/20166462/>
- [15] Glezen W. P., Jordana K., Schmier M. A., et al. The Burden of InfluenzaB: A Structured Literature Review. *Am J Public Health.* 2013, 103: e43-51. <https://doi.org/10.2105/AJPH.2012.301137>
- [16] Mancinelli L., Onori M., Concato C., et al. Clinical features of children hospitalized with influenza A and B infections during the 2012-2013 influenza season in Italy. *BMC Infectious Diseases.* 2016, 16: 6-13. <https://doi.org/10.1186/s12879-015-1333-x>
- [17] Tran D., Vaudry W., Moore D., et al. Hospitalization for Influenza A Versus B. *Pediatrics.* 2016, 138: e20154643. <https://doi.org/10.1542/peds.2015-4643>
- [18] Little P., Francis N. A., Stuart B., et al. Antibiotics for lower respiratory tract infection in children presenting in primary care in England (ARTIC PC): a double-blind, randomised, placebo-controlled trial. *Lancet.* 2021, 398(10309): 1417-1426. [https://doi.org/10.1016/S0140-6736\(21\)01431-8](https://doi.org/10.1016/S0140-6736(21)01431-8)
- [19] Tosif S., Haycroft E. R., Sarkar S., et al. Virology and immune dynamics reveal high household transmission of ancestral SARS-CoV-2 strain. *Pediatr Allergy Immunol.* 2022, 33(7). <https://doi.org/10.1111/pai.13824>
- [20] Spencer S., Gaglani M., Naleway A., et al. Consistency of influenza A virus detection test results across respiratory specimen collection methods using real-time reverse transcription-PCR. *J Clin Microbiol.* 2013, 51: 3880-3882. <https://doi.org/10.1128/JCM.01873-13>
- [21] To K. K., Chan K. H., Li I. W., et al. Viral load in patients infected with pandemic H1N1 2009 influenza A virus. *J Med Virol.* 2010, 82: 1-7. <https://doi.org/10.1002/jmv.21664>
- [22] Uyeki T. M., Hui D. S., Zambon M., et al. Influenza. *Lancet.* 2022, 400(10353): 693-706. [https://doi.org/10.1016/S0140-6736\(22\)00982-5](https://doi.org/10.1016/S0140-6736(22)00982-5)
- [23] Isik A. T. Covid-19 Infection in older adults: a geriatrician's perspective. *ClinInterv Aging.* 2020, 15: 1067-1069. <https://doi.org/10.2147/CIA.S260972>
- [24] Altunkalem Seydi K., Ates Bulut E., Yavuz I., et al. E-mail-based health care in patients with dementia during the pandemic. *Front Psychiatry.* 2022, 13(8): 863923. <https://doi.org/10.3389/fpsy.2022.863923>