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ORIGINAL ARTICLES

CHANGES IN THE INCIDENCE OF SOME RESPIRATORY PATHOGENS DURING THE COVID-19 PANDEMIC IN BULGARIA

Ani Kevorkyan, Stefan Stefanov, Meri Hristamyan, Vanya Rangelova

Department of Epidemiology and Disaster Medicine, Faculty of Public Health, Medical University of Plovdiv, Bulgaria

ABSTRACT

INTRODUCTION: The advent of a novel pathogen, such as SARS-CoV-2, and the subsequent implementation of a range of non-pharmaceutical interventions have resulted in alterations in disease prevalence, particularly in cases transmitted through an airborne mechanism.

AIM: The aim of the present study was to analyze the changes in the incidence of influenza and acute respiratory infections (ARIs), varicella (chickenpox), and scarlet fever, which occurred as a result of the spread of COVID-19 in Bulgaria.

MATERIALS AND METHODS: Official sources of epidemiological information (NCIPD, NCPHA, etc.) and a set of normative documents for the introduced anti-epidemic measures (AEMs) were used. The analysis of the distribution of varicella and scarlet fever covered the 2012–2022 period, and that of influenza and SARS-CoV-2: 2019–2022.

RESULTS: The incidence of varicella in the pre-pandemic period (2012–2019) ranged from 379.11‰ to 437.54‰, and the incidence trend was upward. The addition to the data model for the 2020–2022 period radically changed the trend line to a downward one, with an average rate of decline of 18.5‰, although in 2022, with the liberalization of AEMs, there was a rise (388.82‰), characteristic for the pre-pandemic period. The incidence of scarlet fever in the 2012–2022 period had a downward trend with an average value of 43.08‰ and varied from 42.15‰ in 2012 to 15.62‰ in 2022, with the lowest indicator in 2021 (2.66‰). The most pronounced changes were observed in influenza infection, when no influenza epidemic was registered in 2021.

CONCLUSION: The imposed 16 types of AEMs, mainly until February 2022, modeled the epidemic process of the presented respiratory pathogens.

Keywords: *COVID-19, influenza, scarlet fever, varicella, incidence*

Address for correspondence:
Vanya Rangelova
Faculty of Public Health
Medical University of Plovdiv
15A Vasil Aprilov Blvd
4000 Plovdiv, Bulgaria
e-mail: vanya.rangelova@mu-plovdiv.bg

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INTRODUCTION

The system for the surveillance of infectious diseases in Bulgaria is a three-level one, vertical, and is part of the general National Health Information System. There are well-established traditions in the registration of infectious diseases, with written data for some of them dating back to the beginning of the 20th century The long observation period makes it possible to outline the dynamics and trend of the ep-

idemic process, taking into account the influence of various factors, of which the most important are the immunization programs and the achieved immunization coverage in the group of vaccine-preventable diseases such as poliomyelitis, measles, mumps, rubella, diphtheria. Diseases with an airborne mode of transmission, where the epidemic process is not modeled by interventions such as immunization programs or whose coverage is inadequate, have high incidence rates and seasonal and/or cyclical surges.

The emergence of a pathogen new to the human population, such as SARS-CoV-2, and the associated complex of non-pharmaceutical measures, has led to changes in the incidence of many infectious diseases, especially noticeable in some airborne infections (ARIs) (1,2,3,4).

AIM

The aim of the present study was to analyze the changes in the incidence of influenza and ARIs, varicella, and scarlet fever, which occurred as a result of the spread of COVID-19 in Bulgaria.

MATERIALS AND METHODS

Official sources of epidemiological information (National Center of Infectious and Parasitic Diseases (NCIPD), National Center for Public Health and Analysis (NCPHA), etc.), the information system for sentinel surveillance of influenza and ARIs, and a set of normative documents on the introduced anti-epidemic measures (AEMs) in the country during the pandemic were used (March 2020–April 2022).

The analysis of the distribution of varicella and scarlet fever covered the 2012–2022 period, and that of influenza and SARS-CoV-2 - the 2019–2022 period. The incidence of varicella and scarlet fever was calculated per 100,000 population, and that of influenza and ARIs—per 10,000 population. The least squares method was applied to model the trend. Epidemiological indicators are presented in tabular and graphic form.

RESULTS

In the analysis of the main epidemiological indicators in Bulgaria, characterizing the spread of acute infectious diseases (AIDs) (excluding influenza and ARIs, tuberculosis, AIDS, sexually transmitted infections and COVID-19, which are reported separately), varicella usually takes first place (Fig.1).

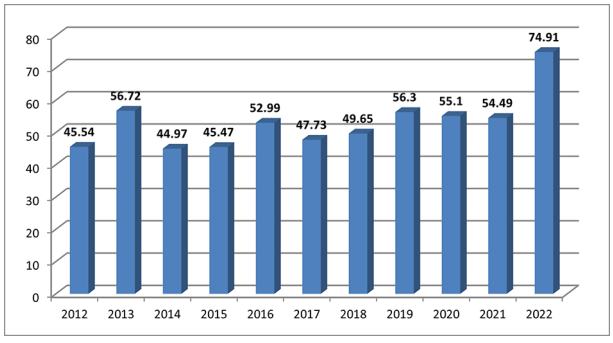

Fig. 1. Relative share of varicella in the structure of acute infectious diseases (%) in Bulgaria (2012–2022).

The incidence of varicella in the pre-pandemic period (2012–2019) varied from 379.11‰ to 437.54‰, and the incidence trend was upward. The addition to the model of data for the 2020–2022 period radically changed the trend line to a downward one, with an average rate of decline of 18.5‰, although in 2022, with the liberalization of AEMs, there was a rise (388.82‰), characteristic of the pre-pandemic period (Fig. 2).

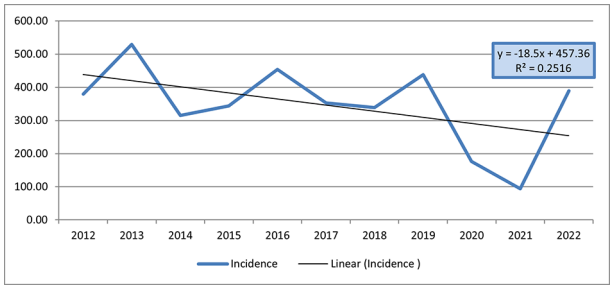

Fig. 2. Incidence of varicella per 100,000 population in Bulgaria (2012–2022).

Since the beginning of 2023 (as of ISO week 39), according to data from the Epidemiological Bulletin of the NCIPD (5), 26,644 cases have been registered in the country. For the same period in 2022, 17,579 cases were registered, the deviation from the previous year being +9,065.

Pronounced changes in the number of patients and, accordingly, in morbidity during the course of the pandemic were also registered for scarlet fever (Fig. 3 and Fig. 4). The incidence of scarlet fever in

the 2012–2022 period had a downward trend (average rate of decrease of 4.86%ooo) and varied from 42.15%ooo in 2012 to 15.62%ooo in 2022, with the lowest indicator being in 2021 (2.66%ooo) (Fig. 4).

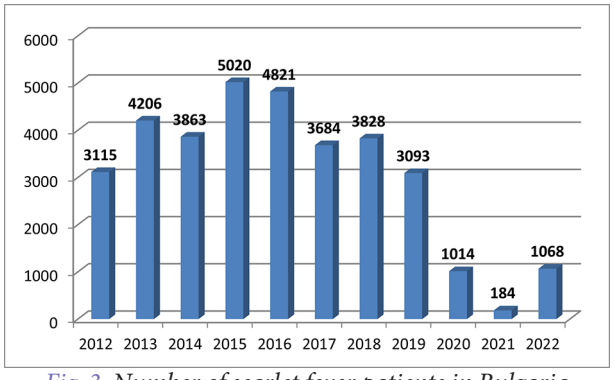

Fig. 3. Number of scarlet fever patients in Bulgaria (2012–2022).

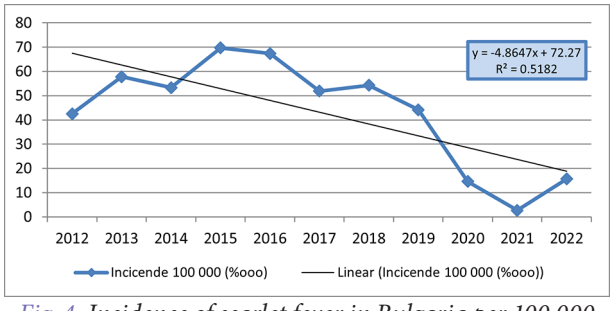

Fig. 4. Incidence of scarlet fever in Bulgaria per 100,000 population (2012–2022).

Since the beginning of 2023 (as of week 39), according to data from the Epidemiological Bulletin of the National Center for Disease Control and Prevention (5), 9,181 cases have been registered in the country. For the same period in the past year (2022), 268 cases were registered, and the deviation from the previous year was + 8913.

The most pronounced changes were observed in influenza and ARIs, and no influenza epidemic was registered in 2021. A total of 2,316 samples of sick and contact persons with influenza were examined in the Influenza and ARI National Reference Laboratory with real-time PCR (RT-PCR) and A(H3N2) was isolated in only 1 patient—infected outside the country (6). Fig. 5 and Fig. 6 show the changes in the number of patients and morbidity by age groups during the 2019–2022 period, with the most pronounced decrease being observed in 2020.

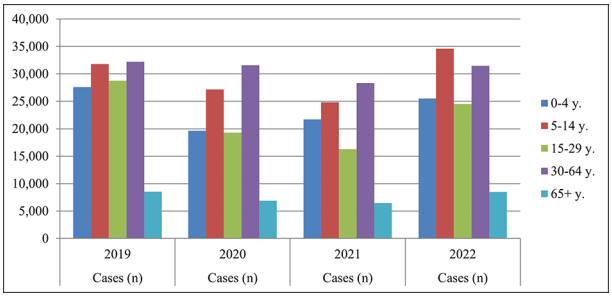

Fig. 5. Number of people suffering from influenza and ARIs by age group in Bulgaria (2019–2022).

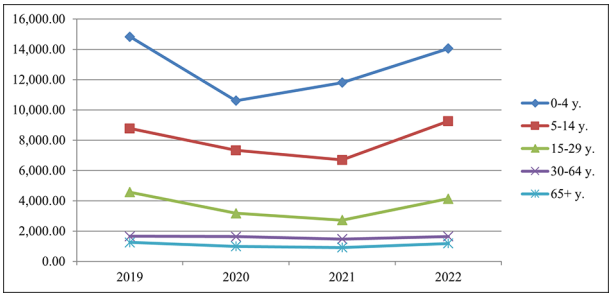

Fig. 6. Incidence per 10,000 population of influenza and ARIs by age groups in Bulgaria (2019–2022).

The presented changes in the number of patients and the morbidity of these three airborne infections in the 2020–2022 period, compared to the pre-pandemic year 2019, are closely related to the applied complex of administrative and non-pharmaceutical measures at a national/regional level (Table 1).

DISCUSSION

Authors in Australia, in order to assess the potential effect of introduced measures against COVID-19 on morbidity, divided infectious diseases into three groups: social, imported, and foodborne (2). Diseases such as influenza, invasive meningococcal disease, etc., which spread from person to person and are often associated with social gatherings or interactions, are defined as social. The data from the analysis of the number of patients in 2019 compared to 2020 (the first year of the pandemic), as well as compared to the average value of the preceding five-year period, showed a significant rate of reduction in almost all diseases, regardless of which group they are assigned to (2). Similar observations have been reported in other countries such as Japan, Taiwan, and China (1,3,4). The reason should probably be sought

Table 1. Duration of the introduced anti-epidemic measures (in number of months) for the period March 2020–February 2022 in Bulgaria.

Administrative and Non-Pharmaceutical Measures	Yes	Yes, Under a Condition	No
1. Restrictions on the gathering of the maximum number of persons in public places	8	11	6
2. Requirements for compliance with physical distance	**24**	1	-
3. Restrictions on full-time studies in higher education	9	10	6
4. Restrictions on full-time studies in primary and secondary education	6	13	6
5. Restrictions on full-time study in primary education	5	9	11
6. Suspension of visits to nurseries and kindergartens	6	-	19
7. Introduced remote form of work	**25**	-	-
8. Introduced anti-epidemic measures at workplaces	**25**	-	-
9. Requirement to use protective face masks in open public places	2	11	12
10. Requirement to use protective face masks in closed public places	**23**	1	1
11. Suspension of the activity of sports facilities	2	17	6
12. Suspension of the activity of drinking and food establishments	6	12	7
13. Suspension of the activity of commercial establishments for non-food goods	3	9	13
14. Suspension of mass events (cultural entertainment, scientific, sports, etc.)	4	15	6
15. Suspension of preventive examinations, admission and implementation of planned operative activity, children's and women's consultations, visits to medical institutions.	7	18	-
16. Suspension of use (or introduction of restrictions on use) of city parks and gardens.	1	2	22

in the introduction of strict anti-epidemic measures related to the COVID-19 pandemic, which were adopted worldwide, such as strict isolation and quarantine, wearing masks in public places, including by healthy persons, hand disinfection, social distancing, limitation of social contacts, remote education of learners, ventilation of premises where a larger number of people reside, limitation of international travel, etc. All the listed measures are effective not only for respiratory pathogens, but also for other groups of infectious diseases, mainly due to their synergistic effect on the epidemic process, i.e., targeting the three units of the epidemic process: source of infection, mechanism of transmission, and susceptible population. Our data correlates with what has been established by the cited authors, most pronounced until February 2022, related to the severity and scope of the measures applied in Bulgaria. Based on the definition of social diseases (2), varicella (chickenpox) and scarlet fever can also be assigned to this group. Unlike countries such as Australia and Japan, where varicella is a vaccine-preventable disease, in Bulgaria the vaccine has only been recommended since 2019, and the spread of the varicella zoster virus (VZV) has been influenced only by the complex of non-pharmaceutical measures. The reduction in varicella incidence in individual countries as a result of the measures introduced varies between 16 and 33% in Australia (2) to 90% in France (7). There are interesting observations regarding the prevention of influenza infection and, in particular, the increase in interest

in influenza immunization during the course of the COVID-19 pandemic.

An increase in vaccination coverage was registered in Taiwan (3) as well as in Bulgaria (8,9) in the course of the National Program for the Improvement of Vaccination Prevention of Seasonal Influenza 2019–2022. This fact also has some influence on the epidemic process, but mainly in the cohort of persons over 65 who are subject to this program in the country. Our observed decrease in the indicators of influenza and ARIs in 2020 in all age groups, including among the non-immunized cohorts, is indicative of the impact of non-pharmaceutical measures.

Using modern incidence modeling methods, scientists from China reported a lower than expected incidence of scarlet fever in 2020 compared to the 2011–2019 period, with a reduction rate of 80.79% (10) and attributed this mostly to the cancellation of public events. At the same time, very quickly after the decline in the incidence of scarlet fever in Bulgaria in 2020 and 2021, an increase was observed in 2022, which did not reach the pre-pandemic values (Fig. 3 and Fig. 4). It reflects the trend shared by some of the member countries of the European Region of the World Health Organization (EURO WHO) as of December 2022 (11). An increase in the number of cases of diseases caused by streptococci of group A, as well as scarlet fever, has been registered, including deaths mainly in children under 10 years of age. In this regard, WHO recommendations are aimed at: identification and timely treatment with antibiotics, reduction the risk of potential complications, and transmission reduction. Measures such as hand hygiene, respiratory hygiene, and adequate indoor ventilation during the winter season, etc., continue to be reported as important (11).

CONCLUSION

The imposed 16 types of AEMs, mainly until February 2022, modeled the epidemic process of the presented respiratory pathogens. The gradual elimination of administrative and non-pharmaceutical measures led to a return to the values in morbidity characteristic of the pre-pandemic period. In May 2023, WHO canceled the global health emergency related to COVID-19 and, accordingly, the package of measures, which were applied to different extents in individual countries, including Bulgaria. This necessitates directing the efforts of specialists working in the field of public health in search of approaches to increase the awareness and confidence of the population in vaccines and the corresponding immunization programs.

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