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*Original scientific paper*

# HEALTH EXAMINATIONS OF PERSONS UNDER MEDICAL SUPERVISION IN SARAJEVO CANTON BEFORE AND DURING THE COVID-19 PANDEMIC

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**ABSTRACT: Introduction** Data on the prevalence of streptococci, staphylococci, and salmonella in healthy people during the COVID-19 pandemic are lacking, and according to the results of studies related to patients with COVID-19, co-infections with the mentioned bacteria were rare. Since there is not enough data on the prevalence of germinalgia in healthy people at the time of the COVID-19 pandemic, that is The aim of this paper was to present the most frequently isolated causative agents in germ carriers in the period before and during the COVID-19 pandemic. **Material and method** A descriptive study was applied. The data source was the results of microbiological analyzes of nose and throat swabs, as well as examination of the stool of germ carriers, for the period 2018-2022. for Sarajevo Canton. The distribution of the most common isolates is shown. **Results** In the observed period, a total of 1,985 germ carriers were detected from all persons placed under medical supervision. In 2018 and 2019, a total of 73,838 were examined, and 790 (1.70%) carriers were detected. From 2020 to 2022, 79,276 were examined, and 1,195 (1.51%) were found to be germinal. Of the total number of isolates in germ carriers, the most represented was *St. aureus*, a total of 1935 (97.48%). In 2018 and 2019, it was isolated in 758 cases (39.48%), and from 2020 to 2022 in 1177 cases (60.82%). *St. beta haemolyticus* was isolated in 21 cases in 2018 and 2019, and in the same period *Salmonella* spp. code 11. From 2020-2022. *St. beta haemolyticus* was isolated in 14, and *Salmonella* spp. Code 4. **Conclusion** During the COVID-19 pandemic, there was an expected decrease in health examinations performed and a reduced number of detected carriers. During the COVID-19 pandemic, almost twice as many carriers of *St. aureus*, and the number of carriers of *St. beta hemolyticus* and *Salmonellae* spp. The number of germ carriers detected increased in the categories of pupils and students. The reason, the end of lockdown, socializing and inadequate wearing of masks, although according to the recommendations, those categories should also wear masks.

**Keywords:** health surveillance, germology, COVID-19 pandemic

## INTRODUCTION

Germ carriers broadly refers to the symbiosis between a host organism and microorganisms, including bacteria, fungi, viruses, and other microorganisms. This community plays a key role in maintaining homeostasis, the immune system and in the digestive process of many living beings including humans. (1)

Through evolutionary processes, germplasm has adapted to various living conditions, developing specific interactions that often provide mutual benefits.

The germinability of pathogenic microorganisms represents an important challenge in understanding and controlling diseases in various organisms, including humans.

This dynamic interaction between pathogenic microorganisms and their hosts plays a key role in the development of infection and disease.

The germinability of pathogenic microorganisms refers to the specific interaction between pathogens, such as bacteria, viruses, fungi or parasites, and their hosts. This connection often results in serious health consequences for the host, as pathogens use different strategies to survive, reproduce, and cause disease. (2,3)

The variety of mechanisms by which pathogens cause disease include invasiveness, toxin production, the ability to evade the host's immune response, and other evolutionarily adapted strategies.

Understanding these mechanisms is crucial for the development of targeted therapies and preventive measures.

These pathogens have a significant impact on global public health, causing epidemics and pandemics, and posing challenges to medical systems and researchers. Timely recognition and suppression of germs is crucial for the prevention and control of infections.

Advances in molecular biology and other scientific disciplines enable the development of innovative approaches in the fight against pathogenic microorganisms. This includes the development of new antibiotics, vaccines and therapeutic strategies directed at specific targets.<sup>(4)</sup>

In the Law on the Protection of the Population from Infectious Diseases (Official Gazette of the FBiH, No. 29/05), special measures for the prevention and control of infectious diseases also include health surveillance of germ carriers, employees and other persons. <sup>(5)</sup>

Obligatory health check-up (sanitary check-up) is performed for certain categories of employees, other persons and germ carriers, which is carried out in order to prevent the occurrence of infectious diseases, under the conditions, within the deadlines and in the manner prescribed by the current legislation. <sup>(6,7)</sup>

Health examination of persons under medical supervision (sanitary examination) includes:

taking material and bacteriological examination of swabs of the throat and nose for germs (cooks, bakers, traders, restaurateurs, persons employed in preschool institutions, health workers, including pupils and students during education, persons working in the production, furnishing and dispensing of medicines, hairdressers, beauticians, persons who work in the production or sale of products for the hygienic needs of the population), collection of material and bacteriological examination of stool for germs and intestinal parasites (cooks, bakers, traders, restaurateurs, persons employed in preschool institutions, health workers employed in maternity and children's wards, hairdressers, beauticians, persons working in the production or sale of hygiene products population. <sup>(6,7)</sup>

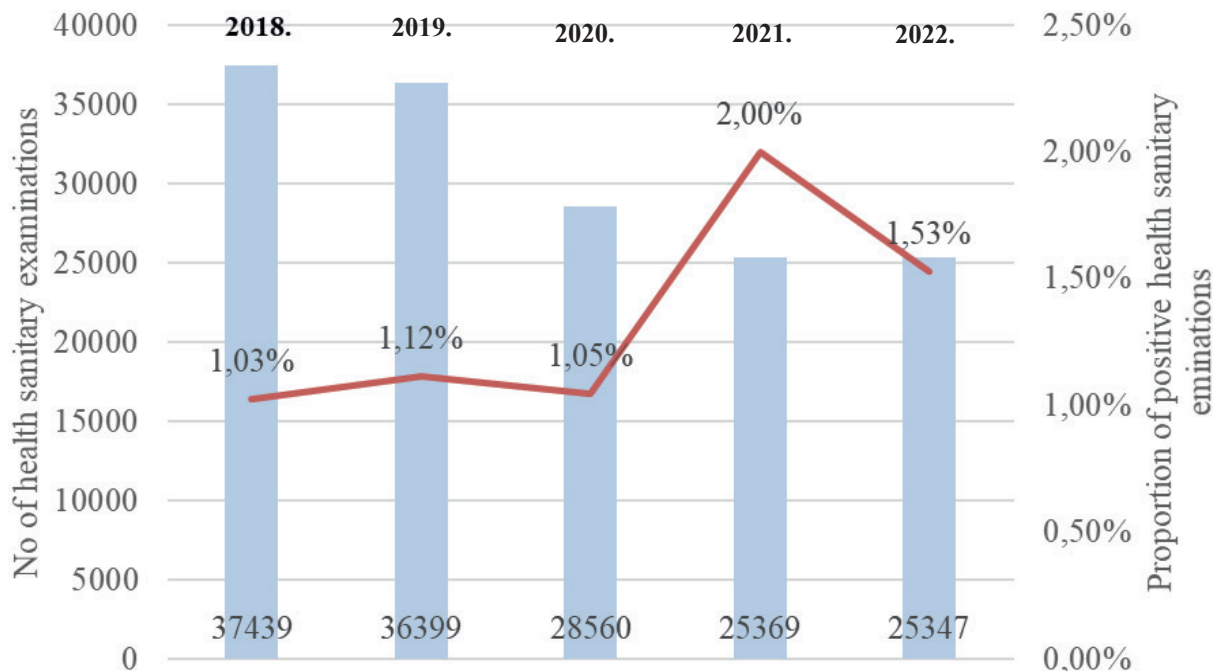
The aim of the work is to show the most frequently isolated causative agents in germ carriers in the period before and during the COVID-19 pandemic.

## METHODS

A descriptive study was applied. The data source was the results of microbiological analyzes of nose and throat swabs, as well as examination of the stool of germ carriers, for the period 2018-2022. of the Microbiology Working Unit of the Institute for Public Health of Sarajevo Canton as well as the Germ Carrier Database of the Epidemiology Working Unit of the Institute for Public Health of Sarajevo Canton. Data processing was performed in the R studio program, and the results are presented graphically and tabularly. The distribution of data by age was tested with the Chi square test, with a significance level of  $p < 0.05$ .

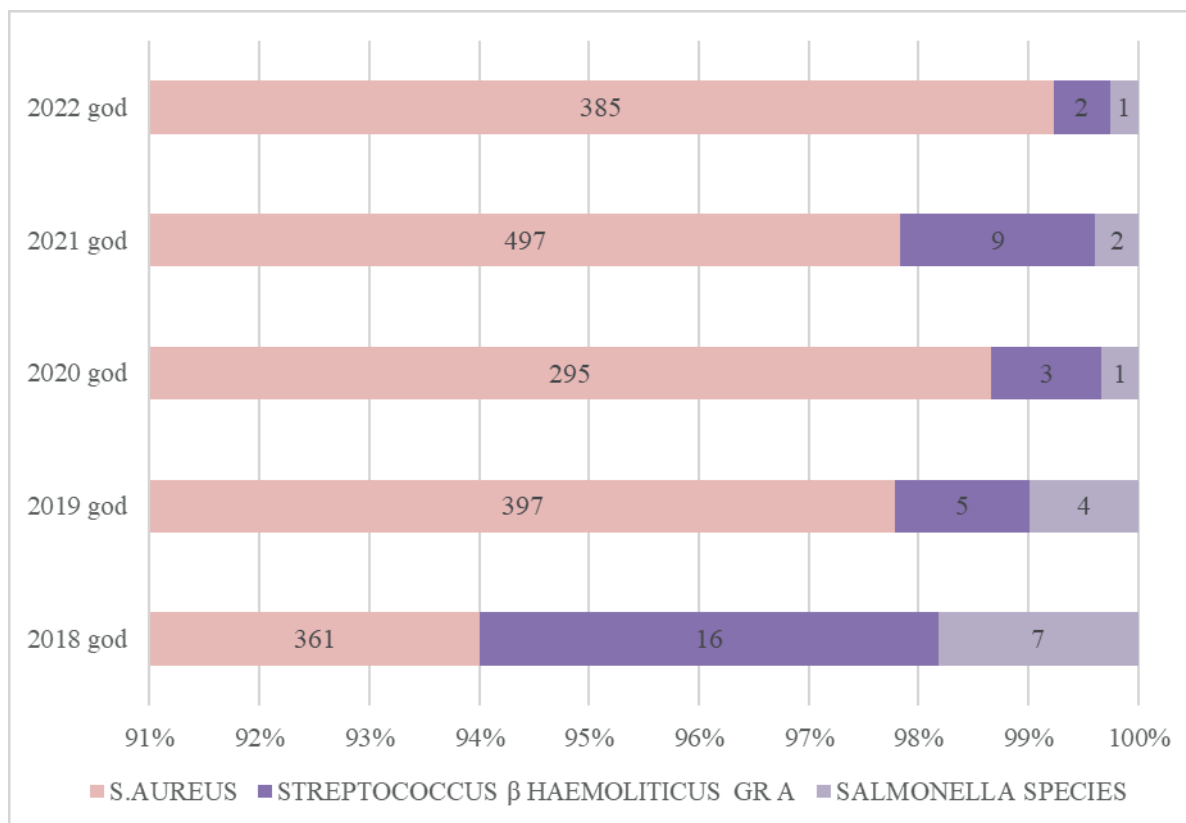
## RESULTS

In the five-year period, a total of 153,114 samples collected during sanitary inspections were analyzed. In the mentioned period, the presence of pathogens was determined in 1,985 samples, that is, in 1.3% of the samples. The analysis of the samples in relation to the year and the proportion of positivity is presented in Graph 1.



**Graph 1.** Number of processed samples and the proportion of positive findings for the presence of pathogens

The analysis shows that during the period of the COVID infection, there was an increase in the proportion of positive analyzes for the presence of bacteria, pathogens, despite the decrease in the number of those tested. In 2021, that is, during the peak of the COVID-19 pandemic, 25,369 sanitary inspections were performed.



**Graph 2.** Proportion of pathogens found in positive samples

**Table 1.** Analysis of the presence of pathogens in relation to the subject's occupation

Year	Caterers	Trade	Water supply	Schools and Faculties	Pre-school institutions	Health institutions - public	Health institutions - public	Pharmaceutical industry and public pharmacies	Private pharmacies	Production, traffic and care services
2018	115 (31.86)	147 (40.72)	3 (0.83)	40 (11.08)	8 (2.22)	23 (6.37)	12 (3.32)	5 (1.39)	2 (0.55)	6 (1.66)
2019	153 (38.54)	156 (39.29)	1 (0.25)	30 (7.56)	6 (1.51)	14 (3.53)	17 (4.28)	10 (2.52)	5 (1.26)	5 (1.26)
2020	108 (36.61)	87 (29.49)	2 (0.68)	49 (16.61)	3 (1.02)	19 (6.44)	8 (2.71)	8 (2.71)	6 (2.03)	5 (1.69)
2021	144 (28.97)	117 (23.54)	7 (1.41)	158 (31.79)	(0)	38 (7.65)	12 (2.41)	12 (2.41)	5 (1.01)	4 (0.8)
2022	107 (27.79)	109 (28.31)	8 (2.08)	81 (21.04)	3 (0.78)	41 (10.65)	21 (5.45)	7 (1.82)	4 (1.04)	4 (1.04)
2018	4 (25)	8 (50)	(0)	2 (12.5)	(0)	(0)	(0)	(0)	1 (6.25)	1 (6.25)
2019	1 (20)	2 (40)	(0)	(0)	(0)	(0)	1 (20)	(0)	(0)	1 (20)
2020	2 (66.67)	(0)	(0)	(0)	1 (33.33)	(0)	(0)	(0)	(0)	(0)
2021	(0)	1 (11.11)	(0)	6 (66.67)	(0)	(0)	1 (11.11)	1 (11.11)	(0)	(0)
2022	1 (50)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	1 (50)
2018	4 (57.14)	2 (28.57)	(0)	1 (14.29)	(0)	(0)	(0)	(0)	(0)	(0)
2019	2 (50)	2 (50)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
2020	(0)	(0)	1 (100)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
2021	(0)	2 (100)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
2022	1 (100)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Staphylococcus aureus

Streptococcus pneumoniae

Salmonella species

Compared to 2018, when 37,439 inspections were performed, it can be seen that at the peak of the COVID-19 pandemic, 32.23% fewer sanitary inspections were performed. Despite this, it is observed that 2% of swabs were present for pathogens.

In the course of 2018, a total of 384 samples were tested for the presence of pathogenic bacteria, of which 94.01% of the samples were positive for the presence of *S. Aureus*, while 4.17% of the samples were positive for group B beta hemolytic streptococcus, and 1.82% on salmonella.

During 2019, 97.18% of positive samples were positive for the presence of *S. Aureus*, 1.23% for group B streptococcus, and 0.99% for the presence of *Salmonella* species.

During 2020, out of a total of 299 positive samples, 98.66% of them had positive samples, 1% *Streptococcus*, 0.33% *Salmonella* species.

During 2021, there were a total of 508 positive samples, of which 97.83% were due to the presence of *S. Aureus*, 1.77% due to the presence of beta hemolytic streptococcus and 0.39% due to the presence of *Salmonella*.

During 2022, a total of 388 samples were processed, of which 385 (99.23%) were positive for the presence of *S. Aureus*, 0.52% for the presence of beta hemolytic streptococcus and 0.26% for the presence of *Salmonella*.

## DISCUSSION

The analysis determined that the largest share of positive findings on the presence of *Staphylococcus Aureus* is mostly found among restaurateurs and traders. In the course of 2021, it was observed that in the population of persons belonging to the category of schools and colleges, 158 of them had a positive smear for the presence of *S.aureus*, which represented 31.79% of all positive findings. In this category are pupils and students who carry out practical teaching related to their education, which includes going to catering facilities, shops or practical work in health institutions, kindergartens and children's collectives. The cause probably lies in the long-term lockdown during the COVID pandemic, which ended that year, which allowed the population of persons belonging to the category of schools and colleges to come into contact and classes took place in schools and colleges and apparently without protective measures. It was observed that in the same period there was no significant increase in positive findings in the category of health workers, which, although the increased number of examinations in health institutions was accompanied by protective measures by health workers. It can be seen that the COVID pandemic has also led to changes in the occurrence of *S. aureus* in the population. ( $\chi^2=172.24$ ,  $p<0.001$ ).

*Streptococcus beta hemolytic* was found mostly among caterers, but during 2021 it was also observed that as many as 66.67% of isolates with the presence of this pathogen were in the group of persons belonging to the category of schools and colleges. *Salmonella* is detected individually, and in 2018 as many as 57.14% of positive samples were among caterers, and 28.57% among retailers. During the COVID pandemic, especially in 2021, two findings with the presence of salmonella were isolated, both in store workers, and in 2022, one isolate was found in caterers.

## CONCLUSION

During the COVID-19 pandemic, there was an expected reduction in health examinations of persons under medical supervision and a reduced number of detected germ carriers. During the COVID-19 pandemic, almost twice as many carriers of *St. aureus*, and the number of carriers of *St. beta hemolyticus* and *Salmonellae* spp. *St. aureus* is one of the most common and common bacterial pathogens in humans, and in about 30% of people it is found in the nasal vestibule. *S. aureus* is ubiquitous among people, it

spreads from person to person by direct or indirect contact through various objects and droplets during sneezing and coughing. The number of carriers detected is increased in persons who belong to the category of schools and colleges that are placed under health surveillance and thus further spread of pathogens is prevented. Although there was a decrease in the number of health examinations during the COVID-19 pandemic, measures for the prevention and control of infectious diseases, which include health surveillance of germ carriers, employees and other persons, have shown their effectiveness.

## REFERENCES

- 1 Smith, A. et al. (2020). Emerging Pathogens: Unraveling the Diversity. *Journal of Infectious Diseases*, 45(3), 321–335
- 2 World Health Organization. (2021). *Global Impact of Pathogenic Microbes: Challenges and Responses*. Geneva: WHO Press.
- 3 Brown, C., & Jones, M. (2019). Mechanisms of Pathogenicity: Insights from Molecular Biology. *Annual Review of Microbiology*, 55(4), 467–488.
- 4 Smilja Kalenić i suradnici (2013). *Medicinska mikrobiologija*, Medicinska naklada Zagreb 2019. 117-124
- 5 [https://fmoh.gov.ba/uploads/files/Zakon\\_o\\_zastiti\\_stanovnistva\\_od\\_zaraznih\\_bolesti\\_29-05.pdf](https://fmoh.gov.ba/uploads/files/Zakon_o_zastiti_stanovnistva_od_zaraznih_bolesti_29-05.pdf)
- 6 [https://kdzifbih.ba/wp-content/uploads/2018/02/Pravilnik\\_o\\_nacinu\\_obavljanja\\_zdravstvenih\\_pregleda\\_osoba\\_pod\\_zdravstvenim\\_nadzorom.pdf](https://kdzifbih.ba/wp-content/uploads/2018/02/Pravilnik_o_nacinu_obavljanja_zdravstvenih_pregleda_osoba_pod_zdravstvenim_nadzorom.pdf)
- 7 <https://dirh.gov.hr/o-drzavnom-inspektoratu-9/ustrojstvo-777-sektor-sanitarne-inspekcije/sprecavanje-i-suzbijanje-zaraznih-bolesti/347>

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