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Impact of the COVID-19 pandemic on culture findings of respiratory specimens in Northern Greece

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COVID-19 pandemic

- **Pandemic** is the emergence of an infectious disease that spreads rapidly across all continents on a global scale and threatens almost the entire population.

- **COVID-19** (Coronavirus disease 19) is defined as an infectious disease affecting the respiratory system caused by **SARS-CoV-2** (Severe Acute Respiratory Syndrome CoronaVirus 2).

- It was declared (WHO) a public health emergency on 30/1/2020, a pandemic on **11/3/2020** and the end of the pandemic was officially announced on **5/5/2023**.

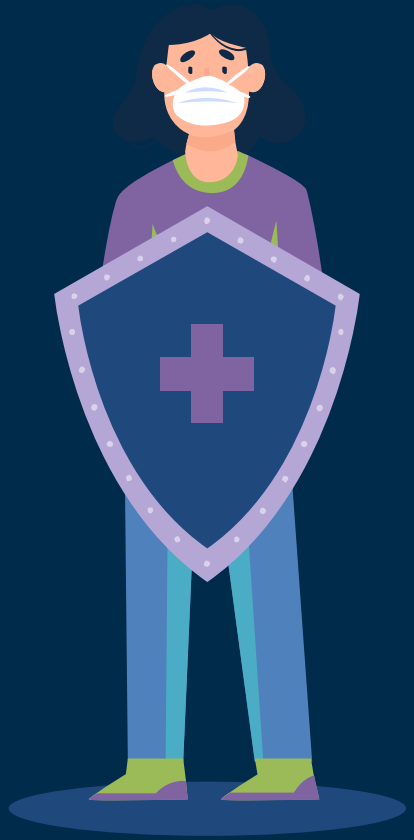
- By 31 December 2023, the pandemic had resulted in **701,204,661** confirmed cases and **6,966,869** deaths (0.99% mortality).

COVID-19 protection measures

Wash your hands often

Use hand sanitizer

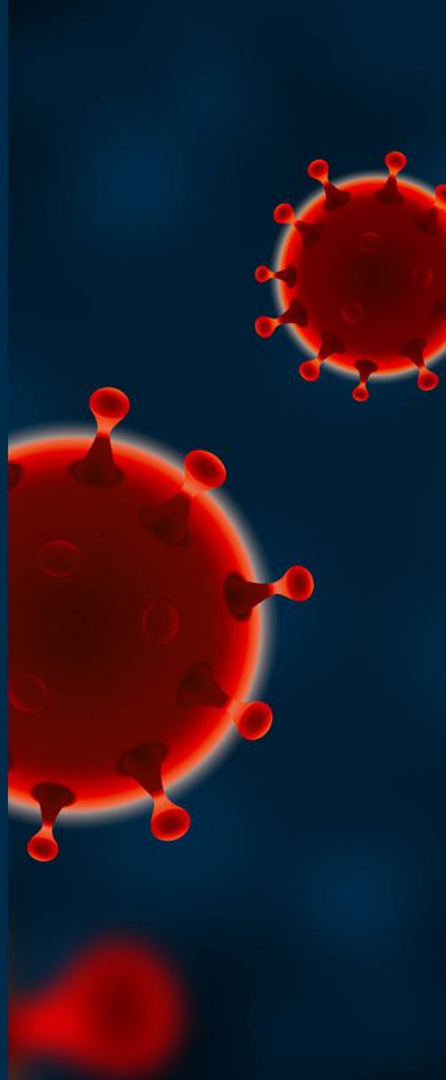
Cover your sneezes and coughs



Wear a mask

Use your own supplies

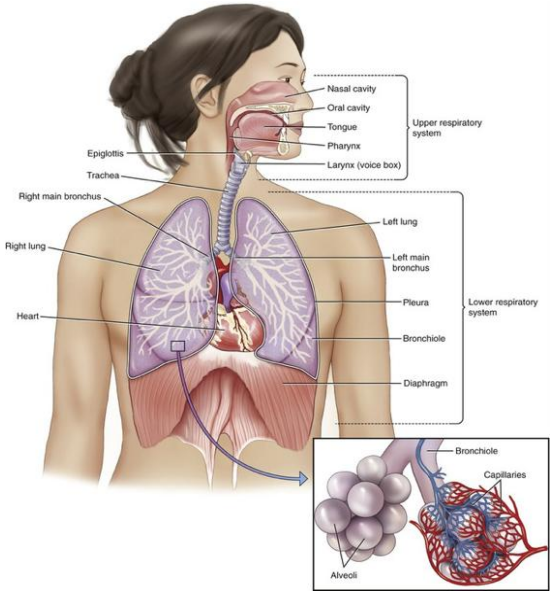
Avoid close contact



Respiratory System

Upper Respiratory System

Nasal cavity
Pharynx
Larynx



Lower Respiratory System

Trachea
Lungs
(bronchi, bronchioles, alveoli)

Specimens

- ✓ Nasal swab
- ✓ Rhinopharyngeal swab
- ✓ Oropharyngeal swab
- ✓ Saliva

Specimens

- ✓ Sputum
- ✓ Tracheobronchial secretion aspirates
- ✓ Bronchoalveolar lavage (BAL)
- ✓ Plugged Telescoping Catheter (PTC)

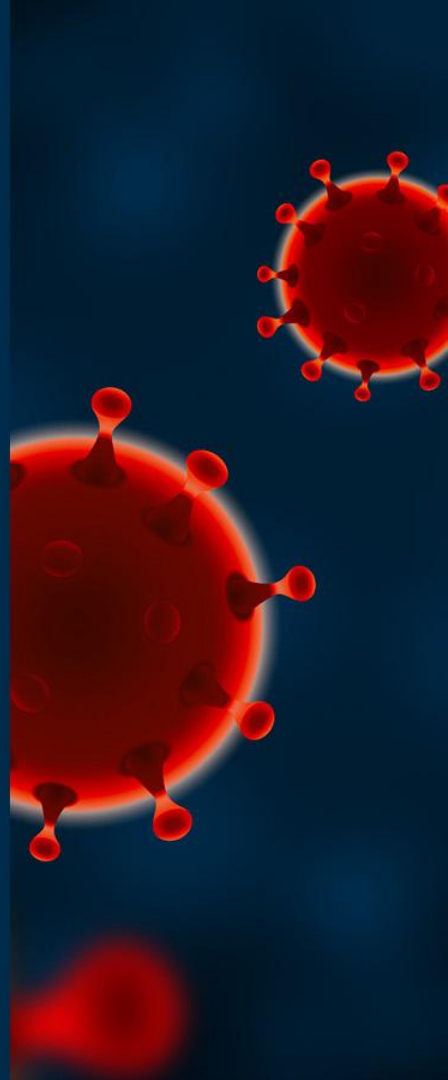
Respiratory system bacterial infections

- Viral infections may damage the respiratory epithelium, thus making patients vulnerable to bacterial respiratory infections.

- Most common causes of bacterial pneumonia:
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae*
  - Opportunistic pathogens *(Pseudomonas aeruginosa, Klebsiella pneumoniae*, *Staphylococcus aureus*, *Proteus spp, Serratia spp)*

Question :

Consequences of a pandemic on other infections ???



Aim of the research

- Retrospective study on respiratory samples
  collected from the population of Northern Greece
  before (2018-2019), during (2020-2022) and after (2023) the COVID-19 pandemic.

- **Investigation** and **evaluation**
  of the quantitative and qualitative **changes**
  in positive **bacterial** cultures,
  probably caused by the COVID-19 pandemic.

Materials and methods

- A retrospective analysis was performed on respiratory samples sent to the Microbiology Laboratory of Papanicolaou Hospital in the period **2018-2023**, regardless of gender and age.
- A total of **18,852** samples were recorded (12,277 [65.1%] **men**; 6,575 [34.9%] **women**).
- 1,209 patients **<35 years** of age; 8,237 patients **35-65 years**; 8,594 patients **>65 years**; in 812 samples no age was reported.
- Statistical analysis of the data was performed using SPSS v.27 IBM software. The level of statistical significance is $p<0.05$.

Types of samples :

- ✓ Pharyngeal swabs
- ✓ Bronchial secretions
- ✓ Sputum
- ✓ BAL
- ✓ PTC

Results

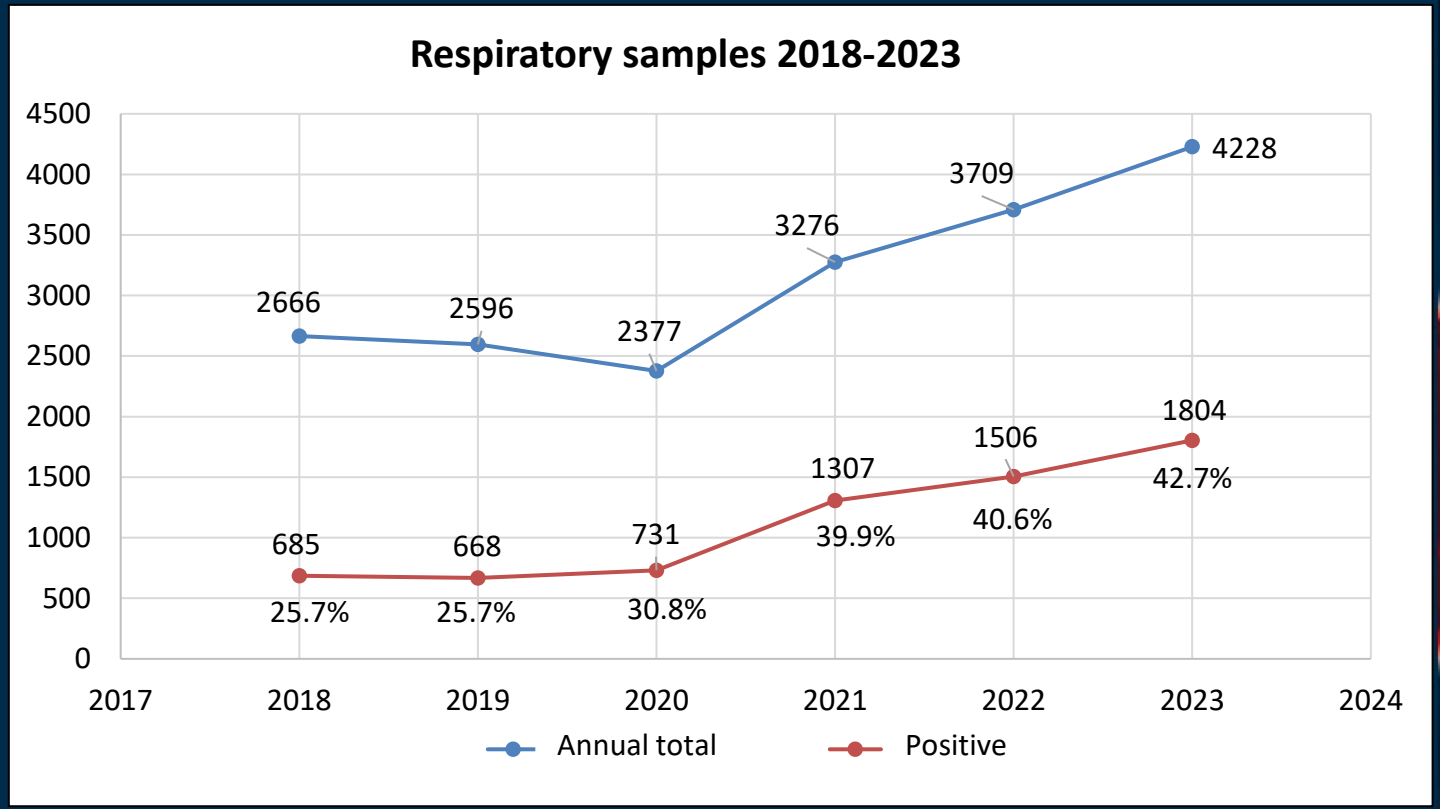


Fig. 1. Respiratory samples tested during the 2018-2023 period.

Results through Statistics
Years

A statistically significant difference is defined when $p<0.05$

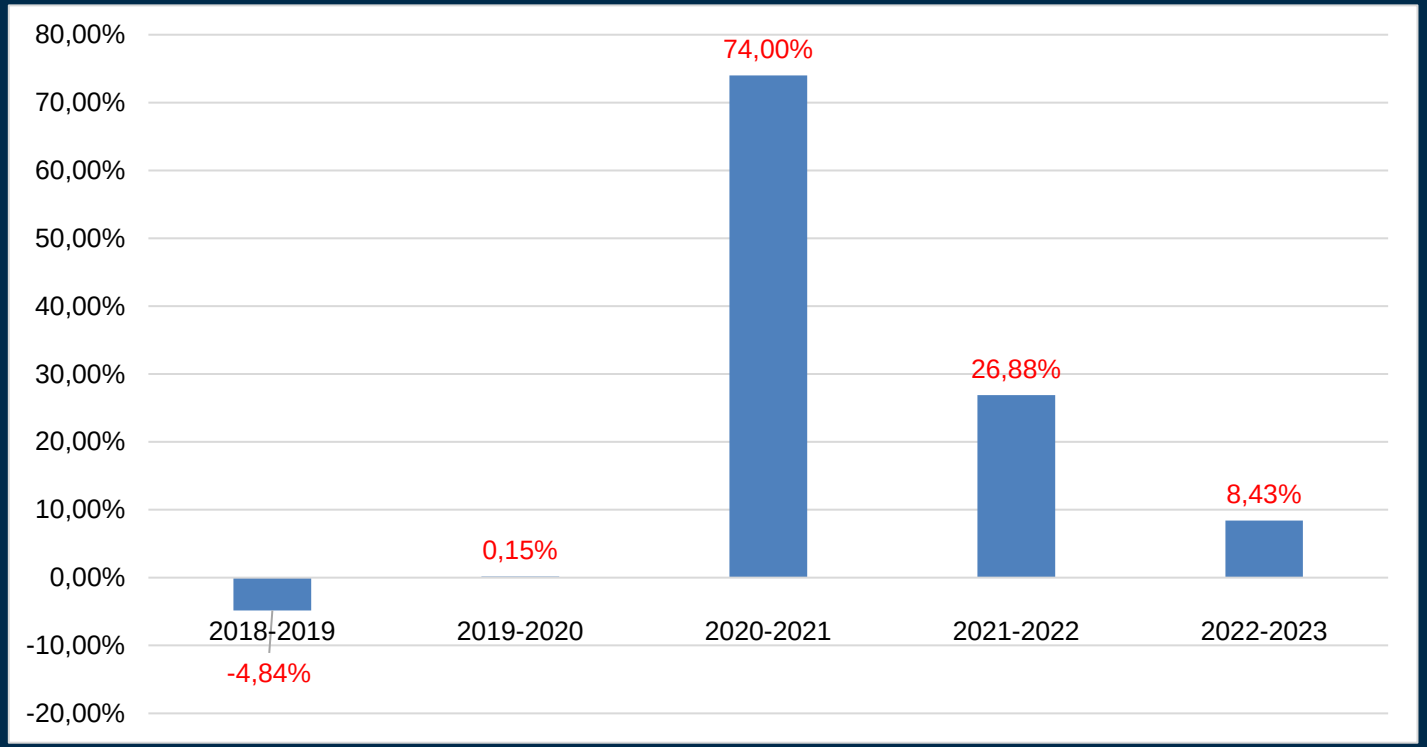
Comparison of positivity between years :

- ✓ **2019-2020 p=0.0001 (for 2020)**
  Statistically significant increase in positives already from the first pandemic year.

- ✓ **2020-2021 p=0.0000 (for 2021)**
  Statistically significant increase in positives in the middle of the pandemic.

- ✓ **2022-2023 p=0.0628 (no statistically significant difference)**
  The percentage of positives remains independent of the typical end of the pandemic.

Changes in isolates proportions compared by year



Results

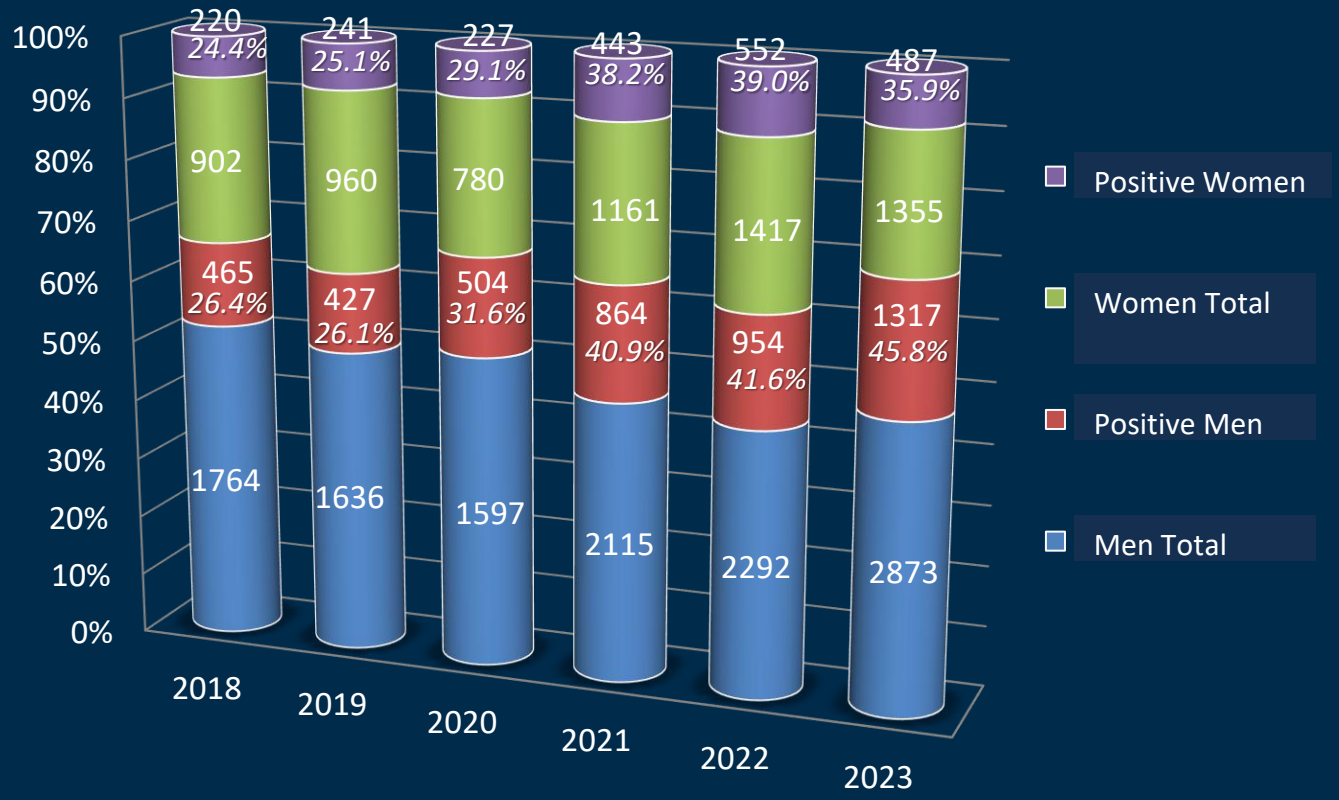


Fig. 3. Distribution of positive samples by gender in the 2018-2023 period.

Results

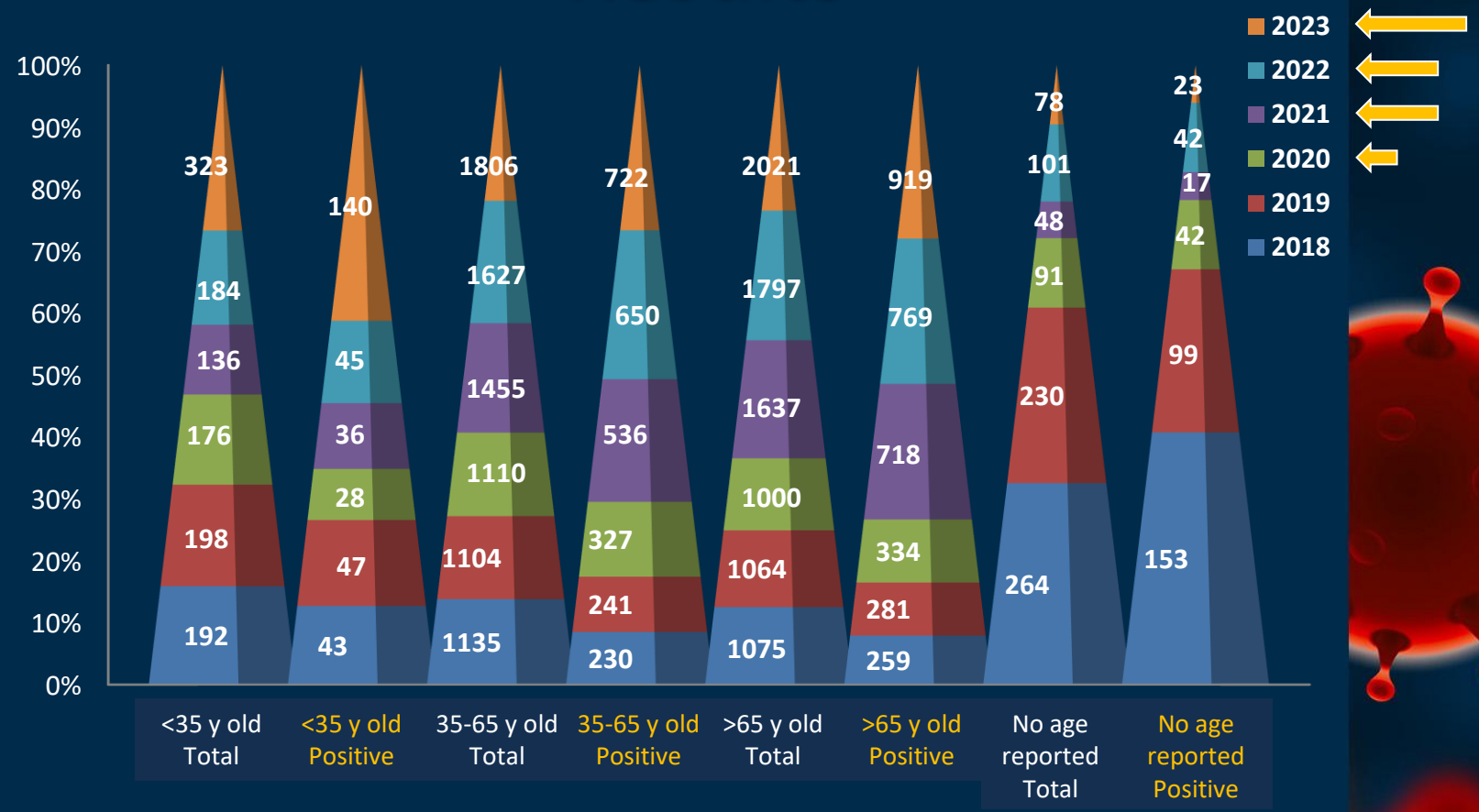


Fig. 4. Analysis by age for the years 2018-2023

Results

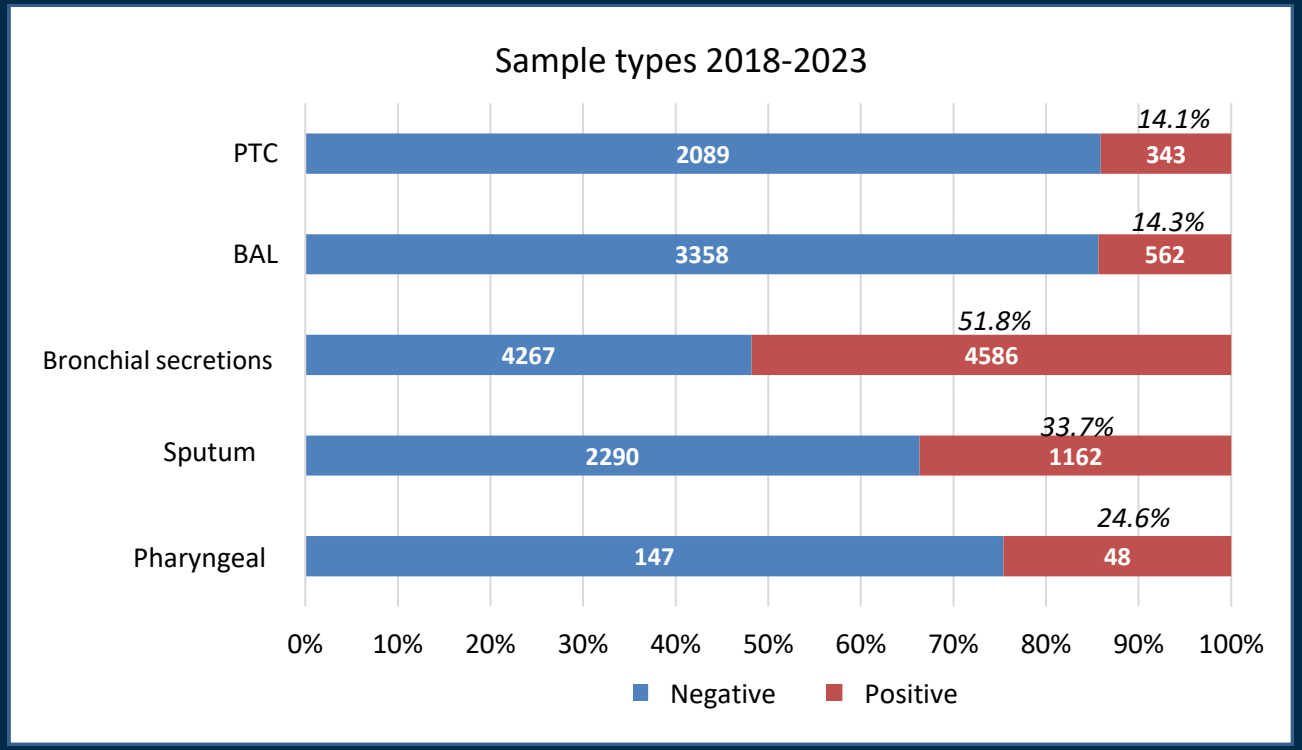


Fig. 2. Types of samples during the period 2018-2023.

Results through Statistics
Specimens

A statistically significant difference is defined when $p<0.05$.

Comparison of positivity for different types of samples :

➢ Pharyngeal swabs – Sputum	p=0.0090 (for sputum)
➢ BAL – Bronchial secretions	p=0.0000 (for bronchial secretions)
➢ PTC – Bronchial secretions	p=0.0000 (for bronchial secretions)
➢ BAL – PTC	p=0.7961 (no statistically significant difference)

- **Bronchial secretions** are shown to have **higher positivity rates**, followed by sputum.
- **BAL** and **PTC** samples can be **equally** used for laboratory diagnosis.

	2018	2019	2020	2021	2022	2023
Acinetobacter spp	127	154	218	475	420	387
	18.6%	*23.7%*	*33.5%*	*42.0%*	*29.3%*	*24.9%*
Enterobacter spp	14	18	22	34	21	31
	2.1%	*2.8%*	*3.4%*	*3.0%*	*1.5%*	*2.0%*
Escherichia coli	9	10	8	21	39	53
	1.3%	*1.5%*	*1.2%*	*1.9%*	*2.7%*	*3.4%*
Haemophilus spp	44	31	15	7	29	28
	6.5%	*4.8%*	*2.3%*	*0.6%*	*2.0%*	*1.8%*
Klebsiella spp	48	41	67	157	183	259
	7.0%	*6.3%*	*10.3%*	*13.9%*	*12.8%*	*16.6%*
Proteus spp	8	27	10	30	62	58
	1.2%	*4.2%*	*1.5%*	*2.7%*	*4.3%*	*3.7%*
Providencia spp	11	4	6	45	119	58
	1.6%	*0.6%*	*0.9%*	*4.0%*	*8.3%*	*3.7%*
Pseudomonas spp	270	215	199	231	361	458
	39.6%	*33.1%*	*30.6%*	*20.4%*	*25.2%*	*29.4%*
Serratia spp	12	7	8	25	33	34
	1.8%	*1.1%*	*1.2%*	*2.2%*	*2.3%*	*2.2%*
Staphylococcus aureus	57	53	32	34	65	52
	8.4%	*8.2%*	*4.9%*	*3.0%*	*4.5%*	*3.3%*
Stenotrophomonas spp	1	10	14	37	39	25
	0.1%	*1.5%*	*2.2%*	*3.3%*	*2.7%*	*1.6%*
Other	81	79	51	35	64	113
	11.8%	*12.2%*	*7.9%*	*3.0%*	*4.4%*	*7.4%*
Total bacterial isolates per year	**682**	**649**	**650**	**1131**	**1435**	**1556**

Analysis for the most important bacteria for the years 2018-2023

Conclusions I

- The **protective measures** applied and especially the emphasis placed on personal hygiene appeared to have a direct relationship with the prevention of respiratory infections in total.

- The maintenance of high rates of positive and total samples after the pandemic is striking, possibly indicating increased **awareness** of health officials and changes in **protocols**, along with a possible increase in patients' **susceptibility** to circulating bacteria.

- The principle of "**the more I search, the more I find**" works in favour of early diagnosis for patients.

Conclusions II

- In any case, bacterial infections **increase with age**.

- The **respiratory specimens** that can be collected for the diagnosis of pneumonia are selected based on each **patient's condition** as they all have significant limitations.

Conclusions III

- **Bronchial secretions** and **sputum** samples present a clearly increased positivity compared to the more specific BAL and PTC.
  They seem having **higher sensitivity** but **lower specificity** in identifying a true pathogen.

- **BAL** and **PTC** samples, strictly collected from intubated patients, appear to be **equally** appropriate for laboratory diagnosis.

- Apart from **bronchial secretions**, other respiratory specimens do not seem particularly affected quantitatively, showing unpredictable fluctuations during the pandemic.


Until a future pandemic…
thank you for your attention!