Impact of the COVID Pandemic in Susceptibility Patterns of Gram-Positive Organisms: A Report from the SENTRY Antimicrobial Surveillance Program

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Introduction

- The impact of the COVID pandemic on antimicrobial resistance has been documented by several studies at local and national levels.
- Reports have recorded the increased prescription of antimicrobial agents and the rise of antimicrobial resistance among several organism groups.
- This study evaluated susceptibility patterns of key Gram-positive (GP) organisms/groups collected worldwide for the SENTRY Program during 2 years of the COVID pandemic (2020–2021) and compared these patterns to those rates from the 3 previous years (2017–2019).

Materials and Methods

- A total of 39,137 Gram-positive isolates, including 28,112 *Staphylococcus aureus* (SA), 8,342 *Streptococcus pneumoniae* (SPN), and 2,683 *Enterococcus faecium* (EFM), were consecutively collected (1 isolate/episode) during the study period.
- Only hospitals participating in all years were evaluated.
- Isolates were susceptibility tested by reference broth microdilution following the CLSI guidelines.
- Results were interpreted using CLSI criteria.
- Differences in percentages were investigated using the Chi-square test to determine statistical significance ($p < 0.05$).

Results

- Statistical significant differences are noted with an asterisk (*) sign.
- Overall, methicillin resistance in *S. aureus* (MRSA) decreased from 34.2% in 2017–2019 to 30.7%* in 2020–2021, except in Latin America (25.0% vs. 30.5%, respectively; Table 1 and Figure 1).
- Notably, North American MRSA rates (42.0% vs. 40.1%) in both of those time periods were higher than all other regions' MRSA rates at the same time (MRSA range, 21.5%–32.7% vs. 18.2%–30.5%; Table 1).
- Azithromycin resistance in *S. aureus* showed a noticeable increase overall (37.6% vs. 42.3%*) and in North America (53.6% vs. 54.3%), Europe (23.0% vs. 29.1%*), and Latin America (42.6% vs. 46.1%), but not in Asia-Pacific (28.6% vs. 20.0%*).
- Azithromycin resistance rates in *S. pneumoniae* also increased in Latin America (35.3% vs. 52.5%*) and Asia-Pacific (51.0% vs. 56.0%), but not overall (36.3% vs. 35.1%).
- North America (45.2% vs. 42.1%) and Europe (22.2% vs. 22.0%) showed slightly decreased or stable azithromycin resistance rates for *S. pneumoniae*.
- Penicillin resistance rates for *S. pneumoniae* were steady overall (0.6% vs. 0.8%) and in North America (0.4% vs. 0.3%), Europe (0.6% vs. 0.6%), and Latin America (2.0% vs. 1.3%), but these rates increased in Asia-Pacific (1.0% vs. 3.3%*).
- *E. faecium* isolates displaying vancomycin non-susceptible MIC values decreased overall (41.9% vs. 38.8%), in North America (67.7% vs. 64.1%) and Asia-Pacific (38.9% vs. 36.3%), while vancomycin non-susceptible *E. faecium* rates increased in Europe (20.8% vs. 23.9%) and Latin America (54.4% vs. 60.0%).

Table 1. Resistance rates of Gram-positive organism to key antimicrobials during 2017–2019 and 2020–2021

Category	2017–2019	2020–2021	Difference	p Value
MRSA				
All regions	34.2	30.7	−3.5	<0.0001
North America	42.0	40.1	−1.9	0.0270
Europe	21.5	18.2	−3.3	<0.0001
Latin America	25.0	30.5	5.0	0.0994
Asia-Pacific	32.7	24.7	−8.0	0.0002
Azithromycin-R *S. aureus*				
All regions	37.6	42.3	4.7	<0.0001
North America	53.6	54.3	0.7	0.6337
Europe	23.0	29.1	6.1	<0.0001
Latin America	42.6	46.1	3.5	0.4300
Asia-Pacific	28.6	20.0	−8.6	0.0002
Vancomycin-NS *E. faecium*				
All regions	41.9	38.8	−3.1	0.1143
North America	67.7	64.1	−3.6	0.3083
Europe	20.8	23.9	3.1	0.1996
Latin America	54.4	60.0	5.6	0.7838
Asia-Pacific	38.9	36.3	−2.6	0.7006
Penicillin-R *S. pneumoniae*				
All regions	0.6	0.8	0.2	0.3840
North America	0.4	0.3	−0.1	0.8083
Europe	0.6	0.6	0.0	1.0000
Latin America	2.0	1.3	−0.7	1.0000
Asia-Pacific	1.0	3.3	2.3	0.0374
Azithromycin-R *S. pneumoniae*				
All regions	36.3	35.1	−1.2	0.3048
North America	45.2	42.1	−3.1	0.0967
Europe	22.2	22.0	−0.2	0.9357
Latin America	35.3	52.5	17.2	0.0174
Asia-Pacific	51.0	56.0	5.0	0.2010

Abbreviations: MRSA, methicillin-resistant *S. aureus*; R, resistant; NS, non-susceptible.

Figure 1. Gram-positive organisms displaying statistically significant differences in antimicrobial resistance rates during 2017–2019 and 2020–2021

Abbreviations: MRSA, methicillin-resistant *S. aureus*; R, resistant; NS, non-susceptible.

Conclusions

- The COVID pandemic changed healthcare practices worldwide, including the use of antimicrobial agents.
- We used the SENTRY Program database to evaluate the impact of these changes on the antimicrobial susceptibility patterns of the main Gram-positive organisms.
- Despite the modest changes in most analyzed parameters, a noticeable increase in azithromycin resistance rates was observed for *S. aureus* and *S. pneumoniae* in Latin America and continuous monitoring is recommended in this region.

Acknowledgements

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