The impact of COVID-19 on the antibiotic resistance in GNB within the Brussels' ICUs

Dr. MORETTI Marco

Internal Medicine & Infectious Diseases Physician (UZ Brussel)

PhD in life science (VUB)

May 27th 2025

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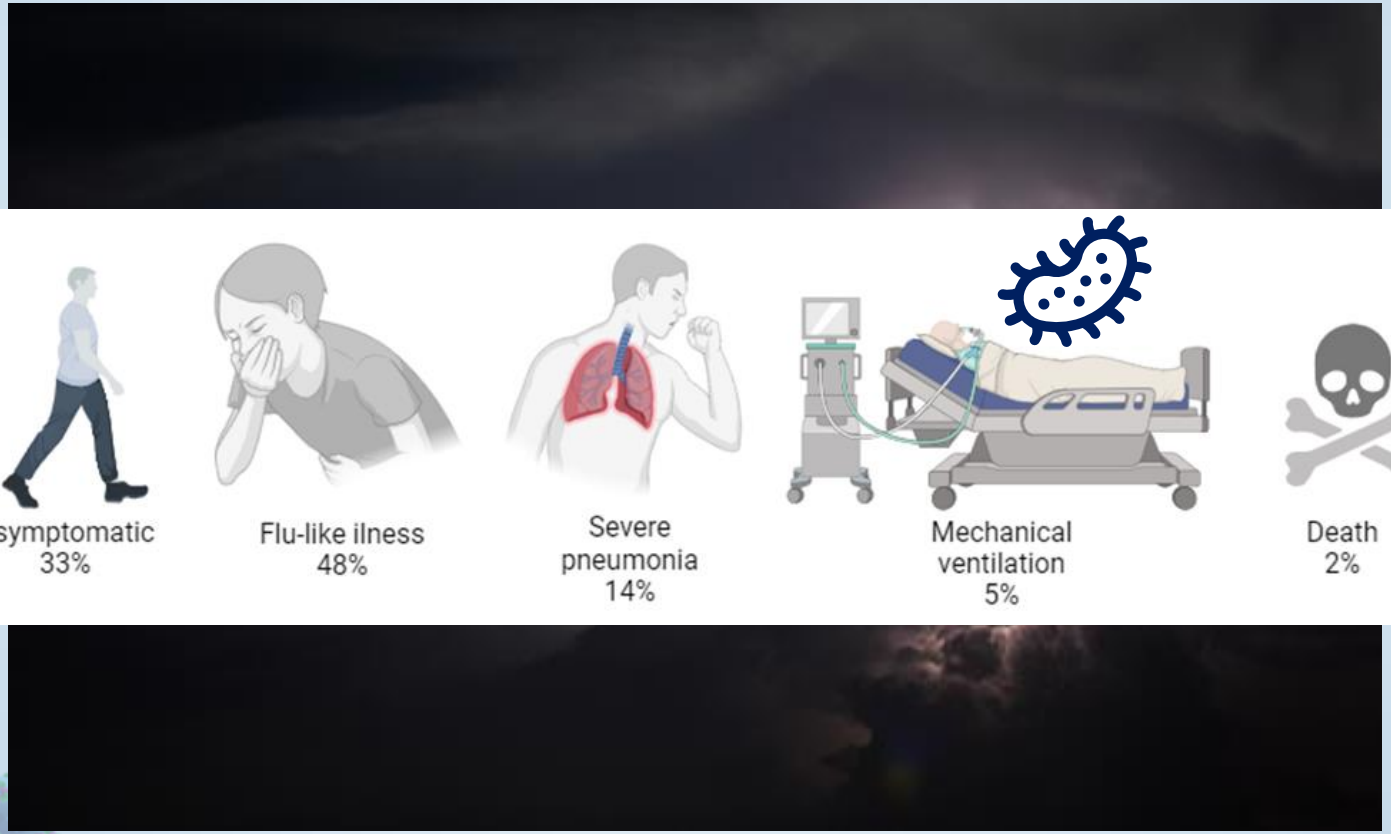
BACKGROUND


Asymptomatic
33%
Flu-like ilness
48%
Severe
pneumonia
14%
Mechanical
ventilation
5%
Death
2%

BACKGROUND

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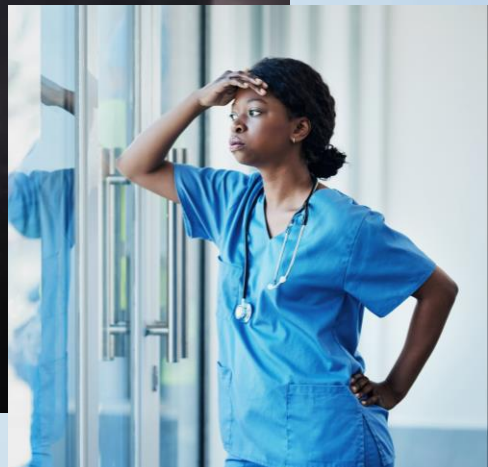

OBJECTIVES

The Impact of **COVID-19 pandemic** on **ICU's bacterial ecology** in Brussels

1. The bacterial **VAP rates** and **predictors in COVID-19** patients
2. The **Trends** of antimicrobial **resistant GNB** in Brussels' ICUs
3. A VIM-PA **outbreak in** the **ICU during** the COVID-19 **pandemic**

VAP: ventilator-associated pneumonia
ICU: Intensive Care Unit
GNB: Gram-Negative Bacteria
VIM-PA: Verona Integron-encoded Metallo-β-lactamase-producing *Pseudomonas aeruginosa*

VAP in COVID-19, a retrospective monocentric cohort study

Marco Moretti, Johan van Laethem, Andrea Minini, Denis Pierard, Manu L.N.G. Malbrain

J Infect Chemother. 2021 Jun;27(6):826-833

INTRODUCTION

Literature research April 2020

No data on VAP in COVID-19 patients

Clinical observations March – April 2020

Frequent VAP

Massive antibiotic exposure

OBJECTIVES

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METHODS

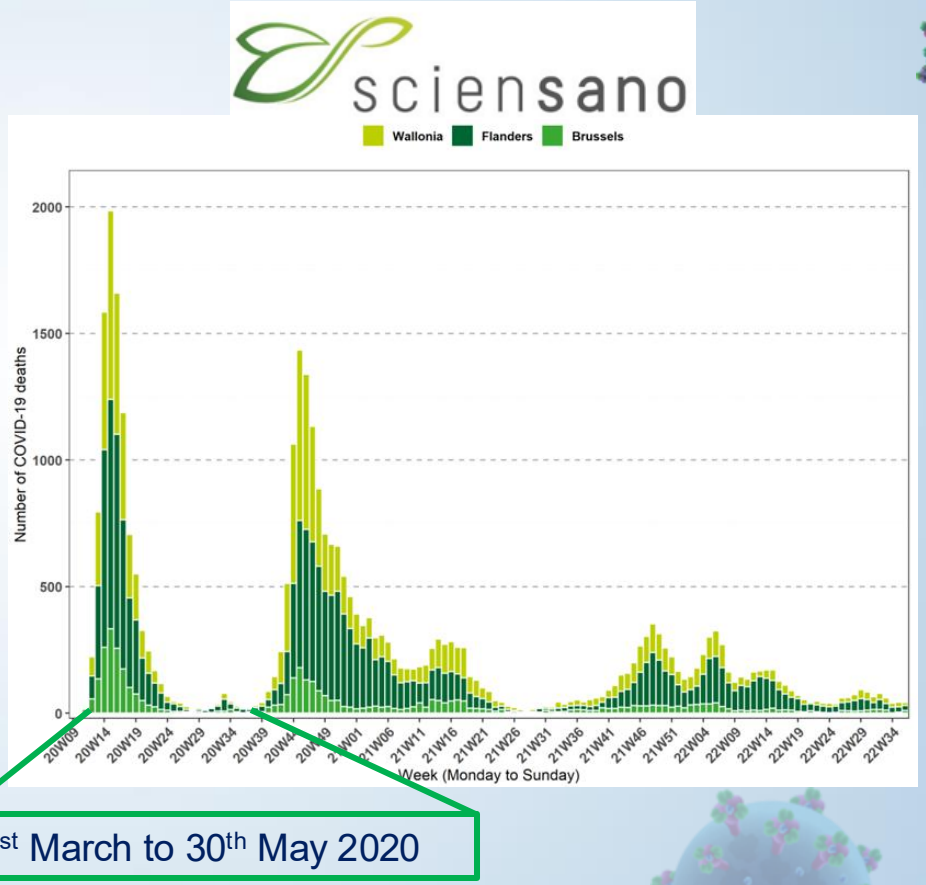
Retrospective Study

ICU Patients

VAP Definition

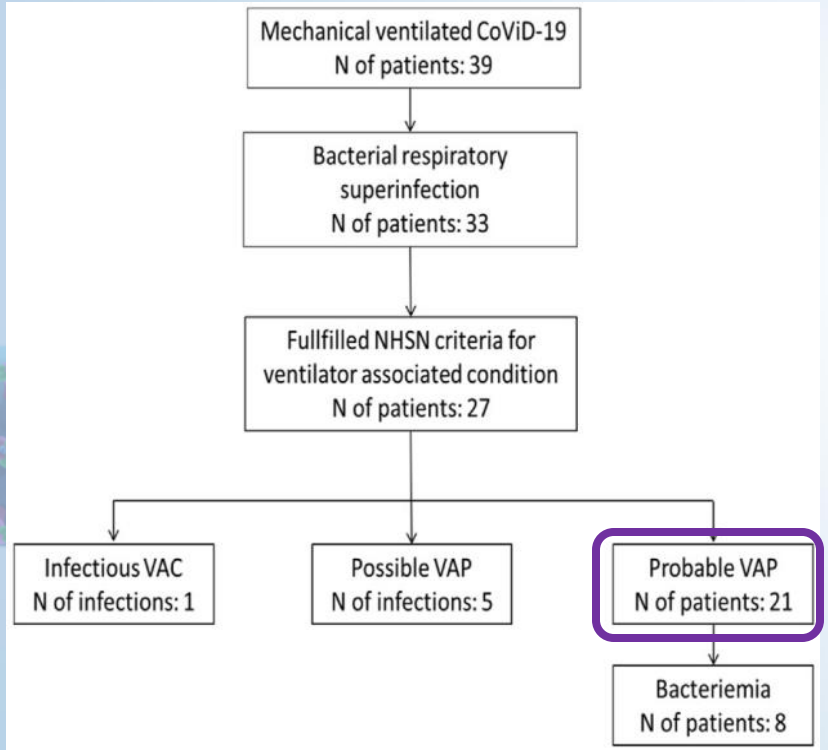
NHSN 2017

Regression Analysis



RESULTS

Study Flowchart



Probable VAP - N: 21

81% under antibiotic in 3 weeks before ICU admission
1-5 antimicrobials regimes
Antibiotic de-escalation following microbiology in 4 patients

Multivariable regression analysis

	OR (95%CI)	P-value
ICU length of stay	**1.06 (1.01-1.12)**	**0.044**
Minimal lung compliance	**0.82 (0.70-0.96)**	**0.013**

CONCLUSIONS

- ✓ ***Rates of VAP during 1st pandemic wave***

54% of mechanically ventilated patients

- ✓ ***Predictive factors for VAP***

length of ICU stay

minimal lung compliance

VAP Definition

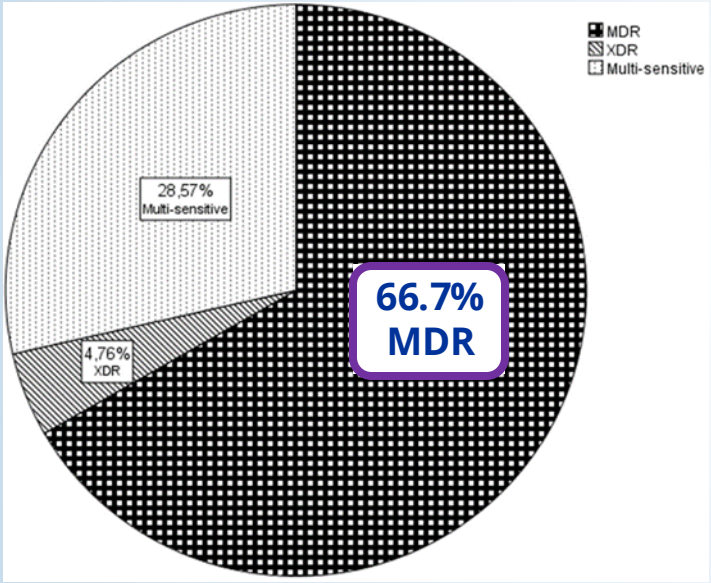
Impact of the COVID-19 pandemic on gram-negative bacteria susceptibility patterns in respiratory samples of ICUs in the Brussels' Capital Region, 2010-2021

Marco Moretti, Véronique Y. Miendje Deyi, Deborah de Geyter, Ingrid Wybo, Marc Claus, Joop Jonckheer, Philippe Clevenbergh, Nicolas Dauby

Am J Infect Control. 2023 Aug 29:S0196-6553(23)00581-3

INTRODUCTION

Bacterial resistance in probable VAP



Widespread antibiotic use in COVID-19 patients

&

Limited de-escalation in function of microbiology

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METHODS

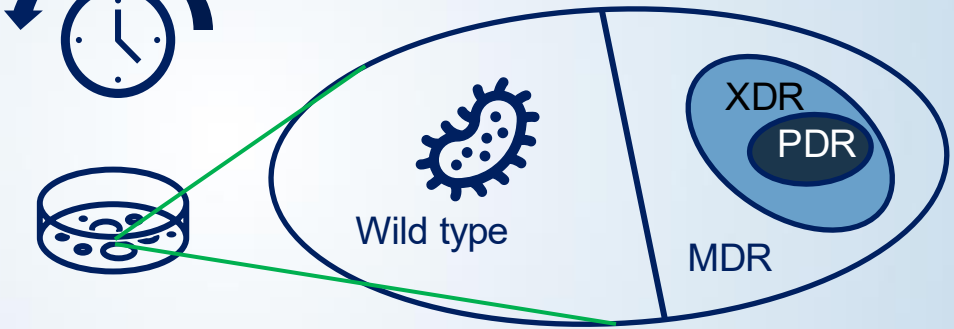
Multicentric Study

Universitair Ziekenhuis Brussel

CHU Saint-Pierre UMC Sint-Pieter

Retrospective Study

Non-susceptibility Patterns



Chi-squares, Regression

6x

MDR: Multi Drug Resistant
XDR: Extensively Drug Resistant
PDR: Pan Drug Resistant

RESULTS

Prevalence of **GNB** during each study period

Bacteria	Total samples n: 10,577	1st period (2010-2011) n: 1,632	2nd period (2012-2013) n: 1,511	3rd period (2014-2015) n: 1,909	4th period (2016-2017) n: 1,572	5th period (2018-2019) n: 1,784	6th period (2020-2021) n: 2,169
Pseudomonas spp.	2,612 (25%)	427 (26%)	355 (24%)	453 (24%)	409 (26%)	432 (24%)	536 (25%)
Klebsiella spp.*	2,021 (19%)	263 (16%)	257 (17%)	350 (18%)	331 (21%)	336 (19%)	484 (22%)
Escherichia spp.	1,778 (17%)	326 (20%)	261 (17%)	340 (18%)	294 (19%)	273 (15%)	284 (13%)
Enterobacter spp.	1,200 (11%)	187 (11%)	154 (10%)	221 (12%)	181 (12%)	208 (12%)	249 (11%)
Serratia spp.	537 (5%)	68 (4%)	69 (5%)	86 (5%)	93 (6%)	113 (6%)	108 (5%)
Acinetobacter spp.	231 (2%)	28 (2%)	62 (4%)	44 (2%)	27 (2%)	32 (2%)	38 (2%)

RESULTS

Trends of **non-susceptibility patterns of GNB** during the 6 study periods

Parameters	Total samples n: 10,577	1st period (2010-2011) n: 1,632	2nd period (2012-2013) n: 1,511	3rd period (2014-2015) n: 1,909	4th period (2016-2017) n: 1,572	5th period (2018-2019) n: 1,784	6th period (2020-2021) n: 2,169
MDR	3,769 (37%)	525 (32%)	483 (32%)	700 (37%)	585 (37%)	626 (35%)	850 (39%)
XDR	894 (8%)	115 (7%)	109 (7%)	128 (7%)	123 (8%)	145 (8%)	274 (13%)
PDR	41 (0.4%)	2 (0.1%)	8 (0.5%)	9 (0.5%)	2 (0.1%)	3 (0.2%)	17 (1%)

RESULTS

Prevalence of resistance patterns over time for ***Pseudomonas***

Parameters	Total samples growing Pseudomonas spp. n: 2,612	1st period (2010-2011) n: 427	2nd period (2012-2013) n: 355	3rd period (2014-2015) n: 453	4th period (2016-2017) n: 409	5th period (2018-2019) n: 432	6th period (2020-2021) n: 536
MDR	935 (36%)	144 (34%)	93 (26%)	137 (30%)	153 (37%)	155 (36%)	253 (47%)
XDR	479 (18%)	72 (17%)	41 (11%)	63 (14%)	84 (20%)	70 (16%)	149 (28%)
PDR	15 (1%)	2 (0.5%)	5 (1%)	4 (1%)	0 (0%)	0 (0%)	4 (1%)
Ceftazidime non-susceptibility	823 (32%)	132 (31%)	80 (22%)	132 (29%)	137 (34%)	118 (27%)	224 (42%)
Piperacillin-tazobactam non-susceptibility	829 (32%)	103 (25%)	80 (23%)	129 (28%)	131 (32%)	128 (30%)	258 (48%)
Meropenem non-susceptibility	745 (28%)	104 (24%)	78 (22%)	89 (20%)	114 (28%)	110 (25%)	250 (47%)

CONCLUSION

- ✓ ***Trends of antimicrobial resistant GNB***

All non-susceptibility patterns increased during COVID-19 pandemic

Clinical parameters

Five-year VIM-producing Pseudomonas aeruginosa outbreak in four Belgian ICUs, an investigation report (2019-2023)

Marco Moretti, Robin Vanstockstaeten, Florence Crombé, Kurt Barbé, Ingrid Wybo, Sabine D. Allard, Joop Jonckheer, Deborah de Geyter

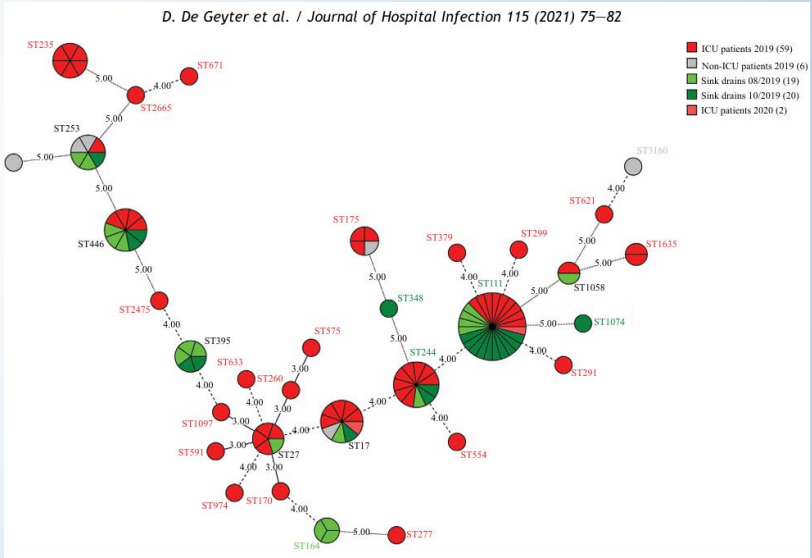
Am J Infect Control. 2024 Aug 30:S0196-6553(24)00689-8

INTRODUCTION

Pseudomonas
principally responsible of the development of resistance

	2018-2019	2020-2021
XDR	16%	28%
Carbapenem non-susceptible	25%	47%

WGS of *Pseudomonas* in the UZ Brussel's ICU



WGS: Whole Genome Sequencing

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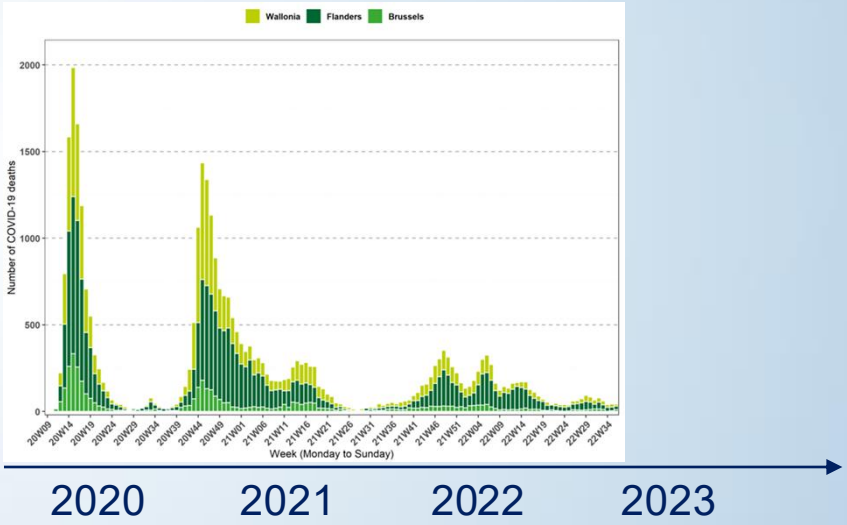
METHODS

Retrospective Study

ICU Patients & Sink-drains

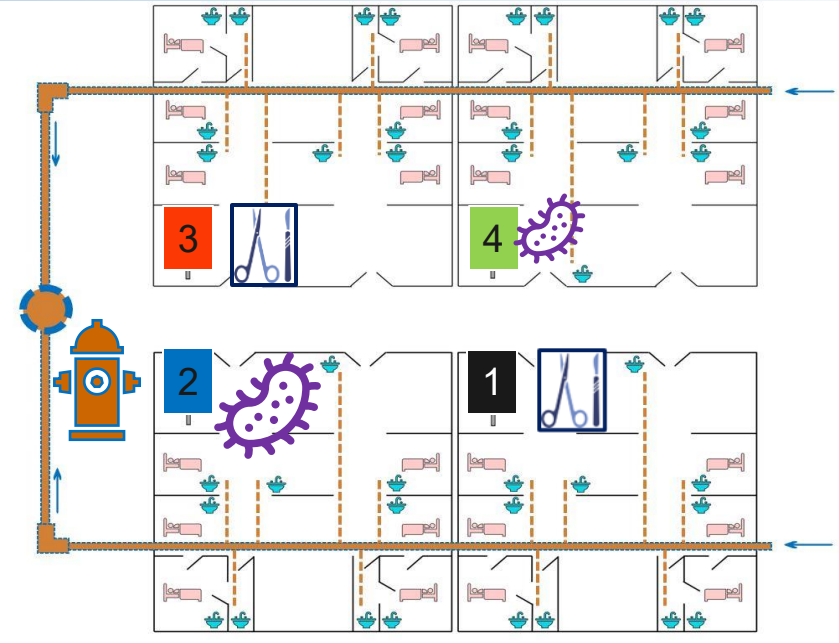
WGS Analysis

Incidence Analysis

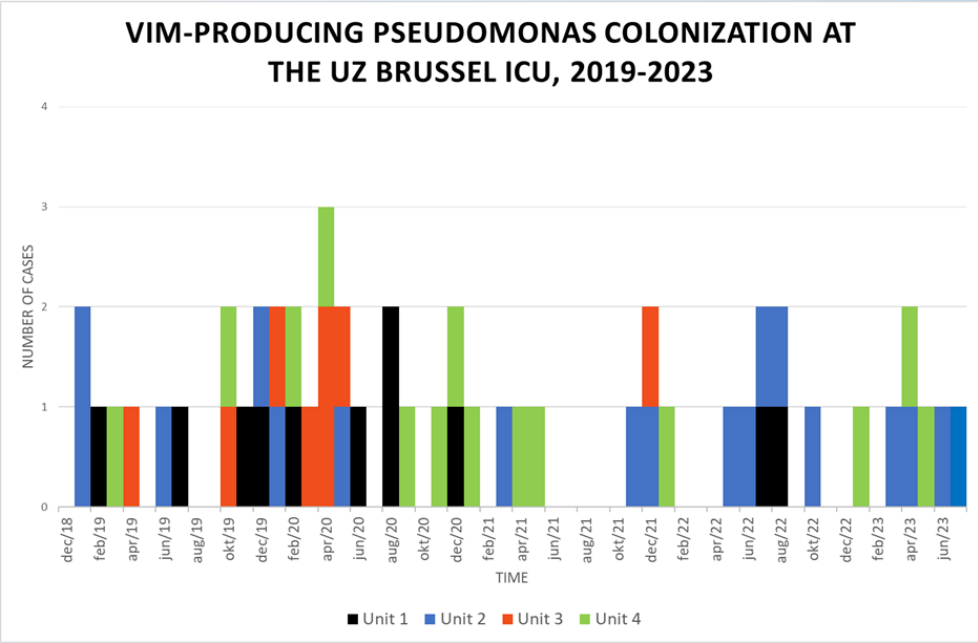


RESULTS

ICU Building Map

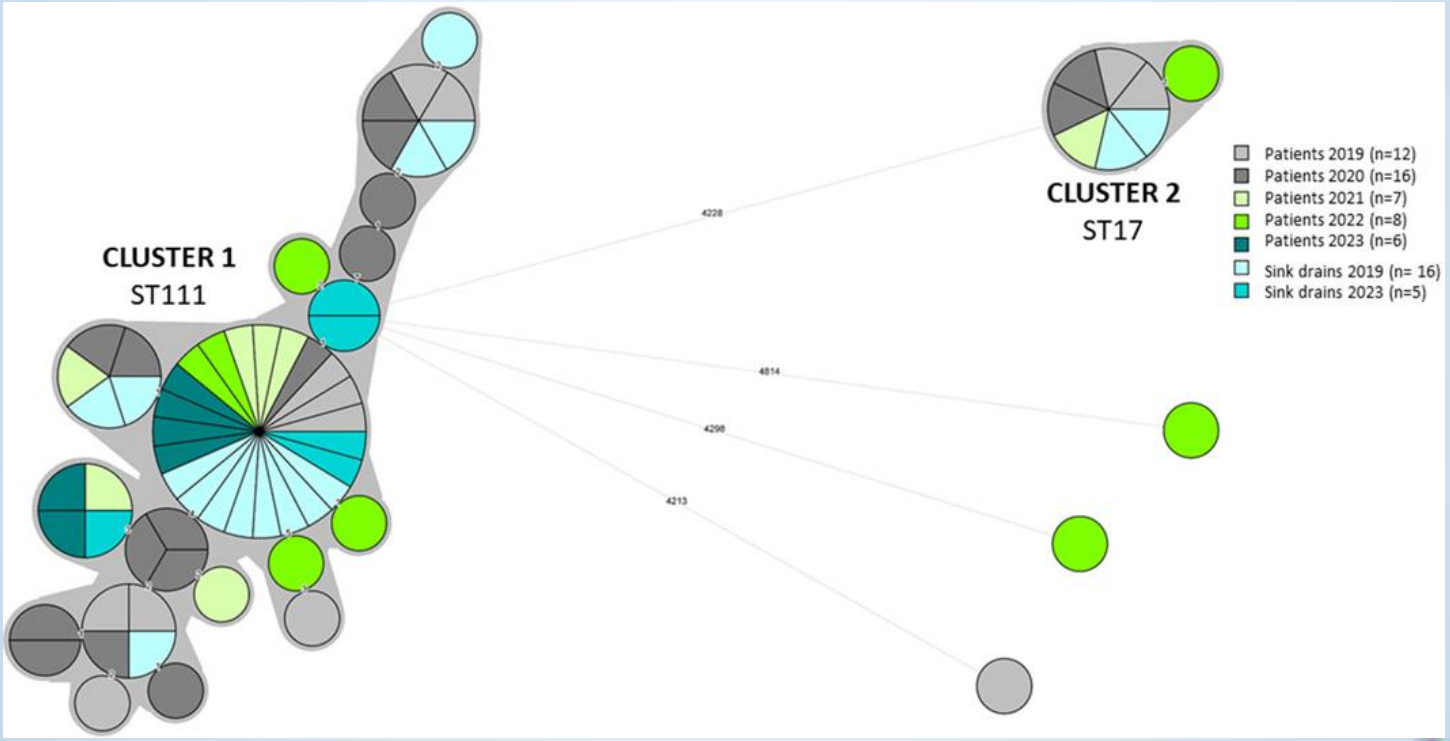


VIM-PA Colonization Prevalence



RESULTS

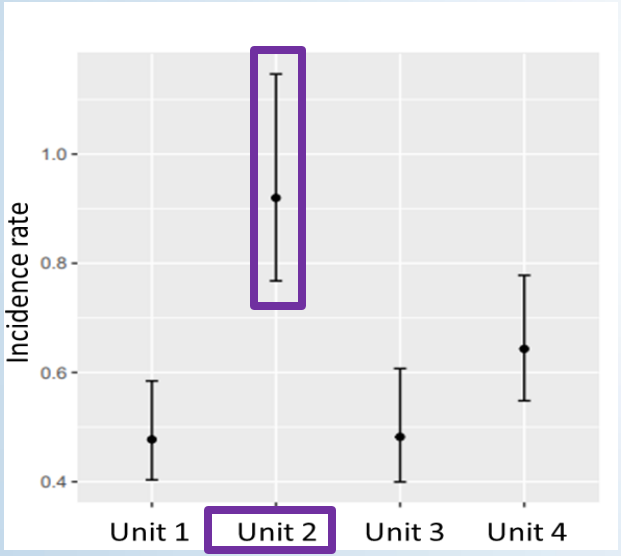
cgMLST analysis for environmental and clinical samples



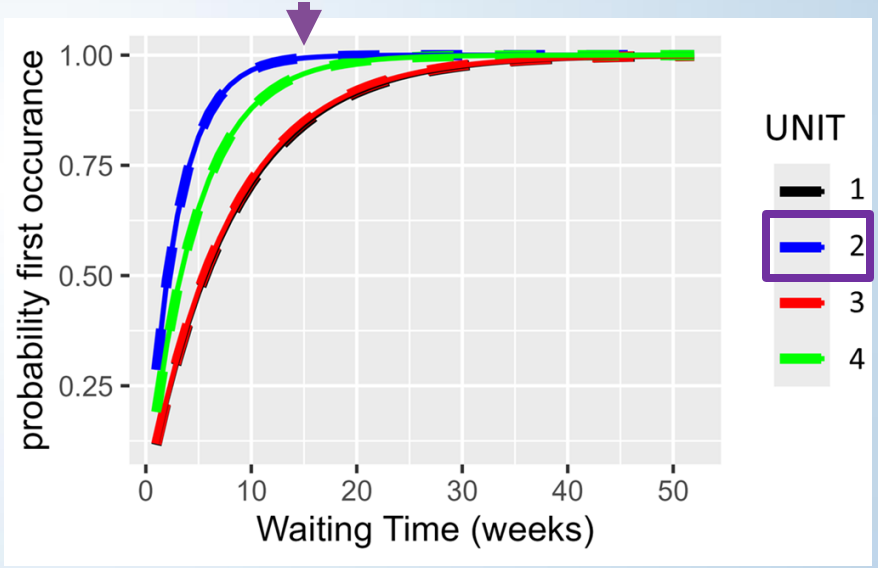
cgMLST: core genome multilocus sequencing typing

RESULTS

Estimation of incidence by regression analysis



Estimation of new VIM-PA colonization events over time



CONCLUSION

- ✓ ***Report of a VIM-PA outbreak within the UZ Brussel ICU***

Sink-drains were identified as the source

Unit 2 had higher incidences of colonization

ICU length of stay

Sink-drain contamination

GENERAL CONCLUSION

- ✓ ***High VAP rates in 1st pandemic wave, associated with ICU length of stay***
  - ✓ Great consumption of antibiotics and prevalence of resistance
- ✓ ***Increased trends of resistant GNB during the pandemic***
  - ✓ Carbapenem-resistant Pseudomonas prevalence surged in the pandemic
- ✓ ***Sink-drains were source of VIM-PA outbreak, higher incidence in Unit 2***
  - ✓ Water-less ICU emerged as the most effective strategy to mitigate the outbreak

THANKS

The impact of COVID-19 on the antibiotic resistance in GNB within the Brussels' ICUs

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PhD in Life Science (VUB)