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healthy all life long

IMPACT OF COVID-19 ON HEALTHCARE ASSOCIATED INFECTIONS

www.nsih.be

ULB UNIVERSITÉ LIBRE DE BRUXELLES

Boudewijn CATRY – for the NSIH team

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Active Healthcare associated infection (HAI): *CARE INFECTIONS*

An infection where **signs and symptoms** are present (**on the day** of the PPS), **or** where signs and symptoms were present in the past and the patient was **(still) receiving treatment** for that infection (on the day of the PPS).

TRESHOLD: =/>3 days

The symptoms had to appear on **day 3 or later after admission** (day of admission = day 1).

It could also be **earlier** in case the patient was **readmitted less than 48 hours** after a previous admission to an **acute care hospital**.

Exceptions:

- **Surgical site infection** (SSI), within 30 days of the operation (90 days if involving an implant).

- **Invasive device** placed on day 1 or 2 of the admission, a HAI could emerge before day 3.

- ***Clostridiodes* (*Clostridium) difficile*** infections present on admission (or developed within two days) with an onset less than 28 days after the discharge from an acute care hospital also had to be included.

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Point Prevalence Survey Healthcare-associated infections Belgium (Vandael et al., Sciensano 2018 www.nsih.be)

Table 5: Distribution of main groups of healthcare-associated infections (HAI), ECDC point prevalence survey (PPS) 2017, Belgium

ECDC = European Centre for Disease Prevention and Control

Number (%) of infections by main HAI group	Patient Specialty				
	Total	Medicine	Surgery	Intensive care	Geriatrics
Pneumonia	197 (21.6%)	69 (24.6%)	20 (9.1%)	49 (**36.3%**)	43 (25.9%)
Other lower respiratory tract infection	45 (4.9%)	10 (3.6%)	2 (0.9%)	14 (10.4%)	10 (6.0%)
Urinary tract infection	194 (21.3%)	57 (20.3%)	39 (17.8%)	12 (8.9%)	54 (32.5%)
Surgical site infection	154 (16.9%)	16 (5.7%)	95 (43.4%)	15 (11.1%)	5 (3.0%)
Bloodstream infection	105 (11.5%)	40 (14.2%)	21 (9.6%)	24 (**17.8%**)	15 (0.9%)
Gastro-intestinal infection	87 (9.6%)	32 (11.4%)	15 (6.9%)	9 (6.7%)	22 (13.3%)
Systemic infection	40 (4.4%)	20 (7.1%)	6 (2.7%)	5 (3.7%)	5 (3.0%)
Skin and soft tissue infection	35 (3.8%)	14 (5.0%)	8 (3.7%)	1 (0.7%)	7 (4.2%)
Eye, ear, nose or mouth infection	19 (2.1%)	10 (3.6%)	1 (0.5%)	0	3 (1.8%)
Catheter-related infection	14 (1.5%)	7 (2.5%)	3 (1.4%)	2 (1.5%)	2 (1.2%)
Cardiovascular infection	9 (1.0%)	3 (1.1%)	2 (0.9%)	3 (2.2%)	0
Bone and joint infection	6 (0.7%)	2 (0.7%)	3 (1.4%)	0	0
Central nervous system infection	4 (0.4%)	0	3 (1.4%)	1 (0.7%)	0
Reproductive tract infection	2 (0.2%)	1 (0.4%)	1 (0.5%)	0	0
Specific neonatal cases	0	0	0	0	0
Total	911	281 (30.8%)	219 (24.0%)	135 (14.8%)	166 (18.2%)

HAI = Healthcare associated infection = nosocomial infection = healthcare-acquired infection = hospital associated = hospital acquired infection = *care infection*

Preventable fraction *care infections*

Intensive care units 6 countries – 78,222 patients (2005-2008):

- Ventilator-associated pneumonia (VAP): 52%
- Blood stream infections (BSI): 69%

(Lambert et al., 2014 Infection Control & Hospital Epidemiology)

Meta-analysis: Significant reduction of 35-55% associated with multifaceted interventions irrespective of a country's income level

(Schreiber et al. 2018 Infection Control & Hospital Epidemiology)

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Incidence *care* infections

Incidence

Rank	Healthcare-associated infections	Inccidence per 100,000
1	Surgical site infection	157
2	HA urinary tract infection	152
3	HA pneumonia	138
4	HA primary bloodstream infection	32.0
5	HA *Clostridium difficile* infection	30.0
6	HA neonatal sepsis	2.90

PLOS Medicine | DOI:10.1371/journal.pmed.1002150 October 18, 2016

DALY: Disability adjusted life years

DALY = YLL + YLD (Lopes, Murray)

•YLL: years of life lost

$$YLL = \sum_{i=0} d_i * e_i$$

d_i : number of deaths in age group i

e_i : LE at age i

•YLD: years lived with disability

$$YLD = \sum_{i=0} I_i * \overline{D_i} * W_i$$

I_i : number of incident cases in age group i

D_i :average duration of the disease (up to cure/ death

Wi:weight of severity of limitation in age group i

Courtesy: H. Van Oyen

Conversion occurrence into burden via Disability Adjusted Life Years (DALYs) – EU

Interaction incidence & DALYs

Rank	Healthcare-associated infections	Inccidence per 100,000
1	Surgical site infection	157
2	HA urinary tract infection	152
3	HA pneumonia	138
4	HA primary bloodstream infection	32.0
5	HA *Clostridium difficile* infection	30.0
6	HA neonatal sepsis	2.90

Rank	Healthcare-associated infections	DALYs per 100,000
1	HA pneumonia	170
2	HA primary bloodstream infection	145
3	HA urinary tract infection	81.2
4	Surgical site infection	58.2
5	HA *Clostridium difficile* infection	31.2
6	HA neonatal sepsis	16.8

Among the studied types of HAI, **HA neonatal sepsis and HA primary BSI** had the highest number of DALYs per case (**12.1 and 8.0 DALYs per case**, respectively), reflecting the severity of these infections for each affected patient. By comparison, in BCoDE 2009–2013, HIV/AIDS had 6.0 DALYs per case, invasive meningococcal disease had 5.6 DALYs per case, and tuberculosis had 3.6 DALYs per case.

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PLOS Medicine | DOI:10.1371/journal.pmed.1002150 October 18, 2016

20% increase in Hospital-associated BSI
26% increase in Tertiary hospitals

The same is observed if assessing HABSI incidence by hospital type. In both, tertiary and other type hospitals, no trend in HABSI incidence was observed between 2013 and 2019. From 2019 to 2020, the HABSI incidence increased statistically significant (Figure 25), at Belgium level at tertiary hospitals by 26% and in other hospital by 20%.

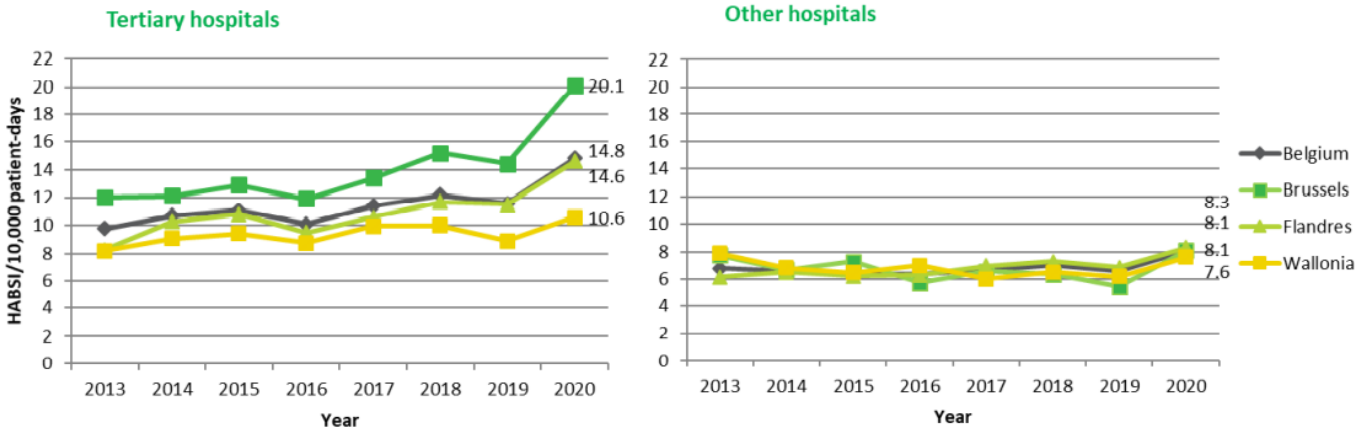

Figure 25: Mean incidence of hospital-associated bloodstream infection in tertiary and other hospitals, Belgium and by region, 2013-2020 (HABSI, hospital-associated bloodstream infection)

[BSI_Report_Sciensano_2021.pdf (nsih.be)]

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	2020 Q1	2020 Q2	2020 Q3	2020 Q4
CLABSI	↓ −11.8%	↑ 27.9%	↑ 46.4%	↑ 47.0%
CAUTI	↓ −21.3%	No Change[1]	↑ 12.7%	↑ 18.8%
VAE	↑ 11.3%	↑ 33.7%	↑ 29.0%	↑ 44.8%
SSI: Colon surgery	↓ −9.1%	No Change[1]	↓ −6.9%	↓ −8.3%
SSI: Abdominal hysterectomy	↓ −16.0%	No Change[1]	No Change[1]	↓ −13.1%
Laboratory-identified MRSA bacteremia	↓ −7.2%	↑ 12.2%	↑ 22.5%	↑ 33.8%
Laboratory-identified CDI	↓ −17.5%	↓ −10.3%	↓ −8.8%	↓ −5.5%

Fig. 1. Changes in the 2020 national healthcare-associated infection (HAI) standardized infection ratios (SIRs) for acute-care hospitals, compared to respective 2019 quarters. Note. CLABSI, central-line–associated bloodstream infection; CAUTI, catheter-associated urinary tract infection; VAE, ventilator-associated event; SSI, surgical site infection; MRSA, methicillin-resistant *Staphylococcus aureus*; CDI, *Clostridioides difficile* infection. Interpretation: Unless otherwise noted, the results of the significance tests comparing consecutive annual pairs of quarterly SIRs are based on a 2-tailed test $P \leq .05$; however, the directional percentage change is based on the relative change in magnitude. An arrow pointing down, and a negative percentage change value, indicate that the 2020 SIR is lower than the 2019 SIR for the same quarter. An arrow pointing up, and a positive percentage change value, indicate that the 2020 SIR is higher than the 2019 SIR for the same quarter. Note. 1. "No change" signifies that the change in SIR was not statistically significant.

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Weiner-Lastinger et al., 2021 (NHSN)

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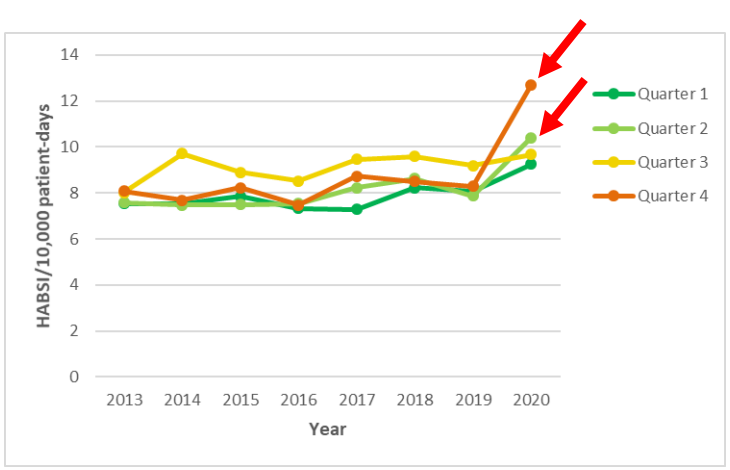
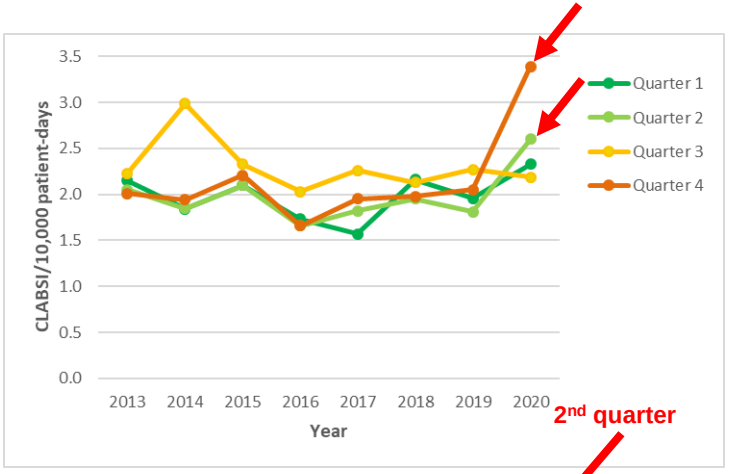
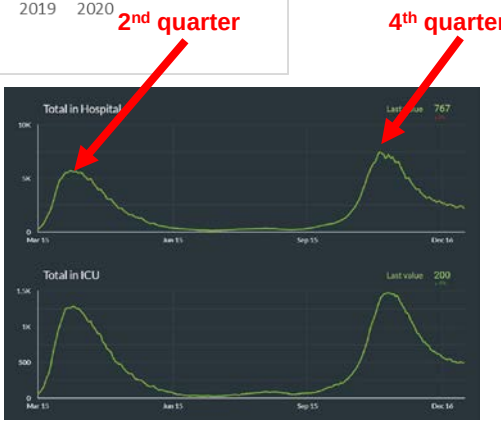
Infection Control & Hospital Epidemiology, DOI: https://doi.org/10.1017/ice.2021.362

Results – HABSI and CLABSI incidence by quarter





Mean incidence of HABSI and CLABSI by quarter, Belgium 2013-2020



HABSI: Healthcare-associated blood stream infections
CLABSI: Central line-associated blood stream infections

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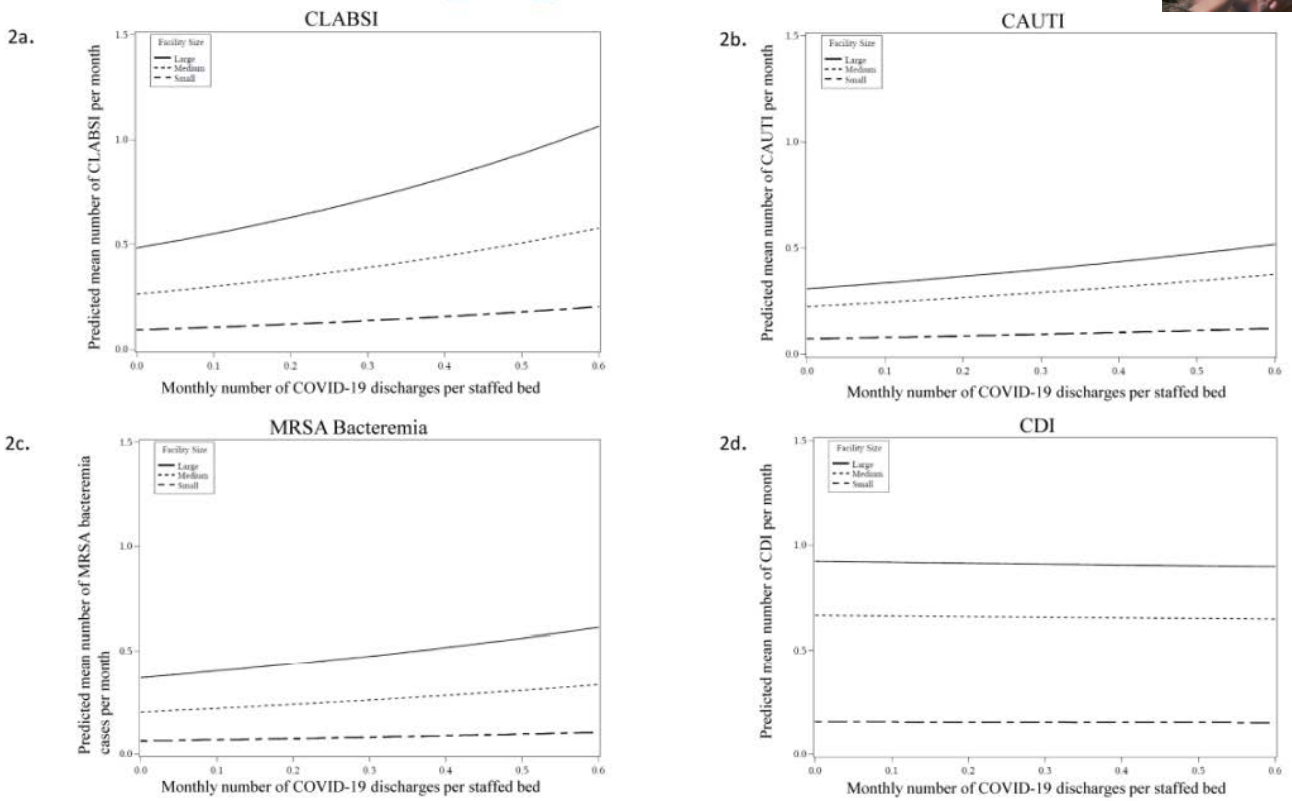
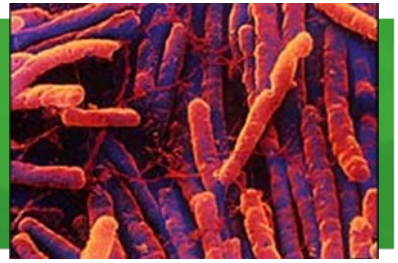
The Impact of COVID-19 on Healthcare-Associated Infections



Summary: COVID-19 surges adversely impact healthcare-associated infection rates and clusters of infections within hospitals, emphasizing the need for balancing COVID-related demands with routine hospital infection prevention.

Meghan A. Baker, MD, ScD1,2*, Kenneth E Sands, MD, MPH1,3*, Susan S. Huang, MD, MPH4 ; Ken Kleinman, ScD5 ; Edward J. Septimus, MD1,6; Neha Varma, MPH1 , Jackie Blanchard RN3 , Russell E Poland, PhD1,3; Micaela H. Coady, MS1 ; Deborah S. Yokoe, MD, MPH7 ; Sarah Fraker, MS3 , Allison Froman, MPH1 ; Julia Moody, MS3 ; Laurel Goldin, MA3 , Amanda Isaacs, MSPH1 ; Kacie Kleja, MS3 , Kimberly M. Korwek, PhD3 ; John Stelling, MD, MPH2 ; Adam Clark, BS2 ; Richard Platt, MD, MSc1 ; Jonathan B Perlin, MD, PhD3 ; For the CDC Prevention Epicenters Program

Clostridioides difficile in hospitals (Callies et al., in press)



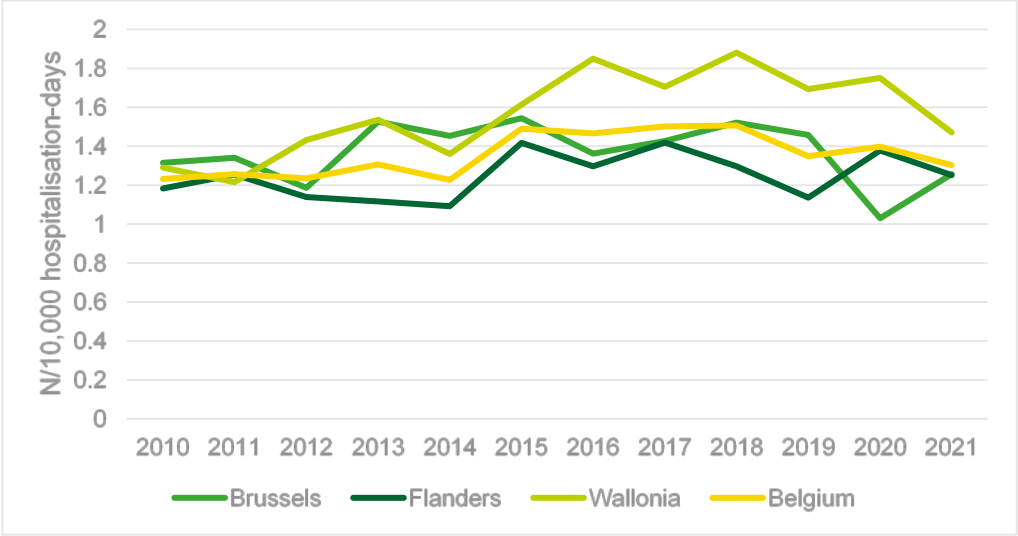


Figure 1: Mean incidence of HA-CDI/10,000 hospitalisation-days in acute care hospitals, per region, Belgium, 2010-2021 (HA-CDI: hospital-associated *Clostridioides difficile* infection; N: number)

Note: Hospital-associated-Clostridioides difficile infection (HA-CDI): onset of symptoms ≥ 2 days after admission. Incidence calculation: inclusion of all acute care hospitals that provided complete data (numerators and denominators) for at least one semester/year in the national surveillance.

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Healthcare-associated bloodstream infections, 2013-2021 Belgium

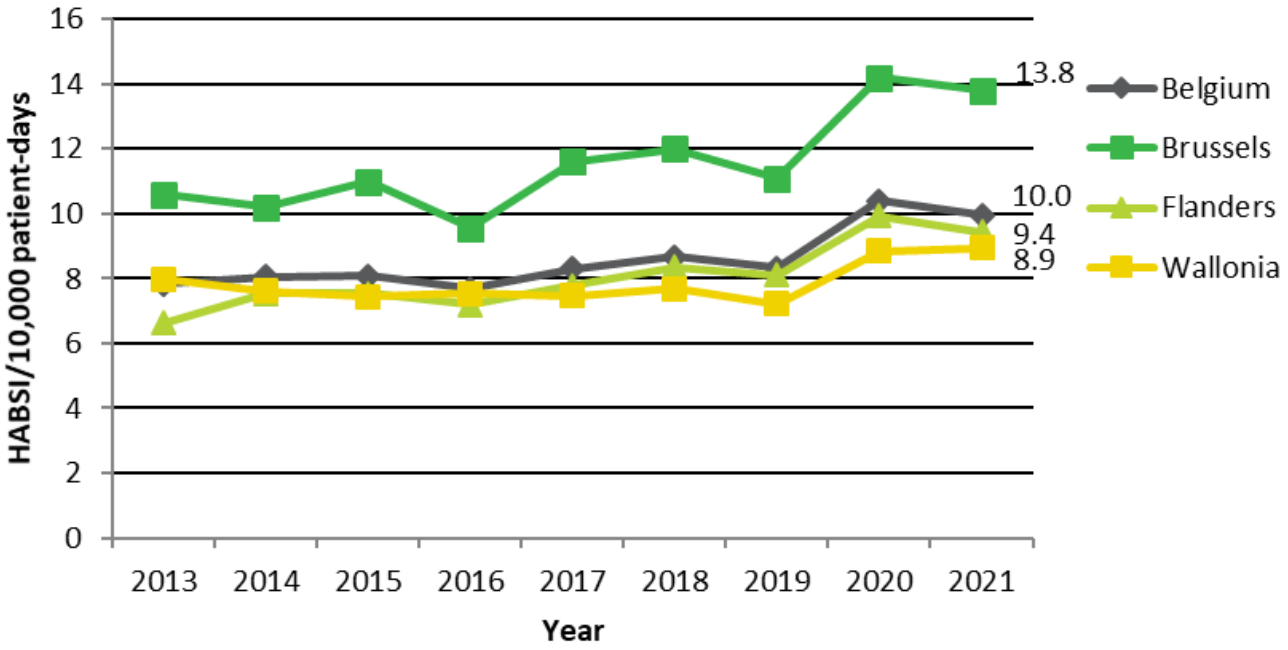

Figure 1: Mean incidence of hospital-associated bloodstream infections, hospital-wide, by region, Belgium 2013-2021 (HABSI, hospital-associated bloodstream infections)

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HABSI stratified by type of hospital

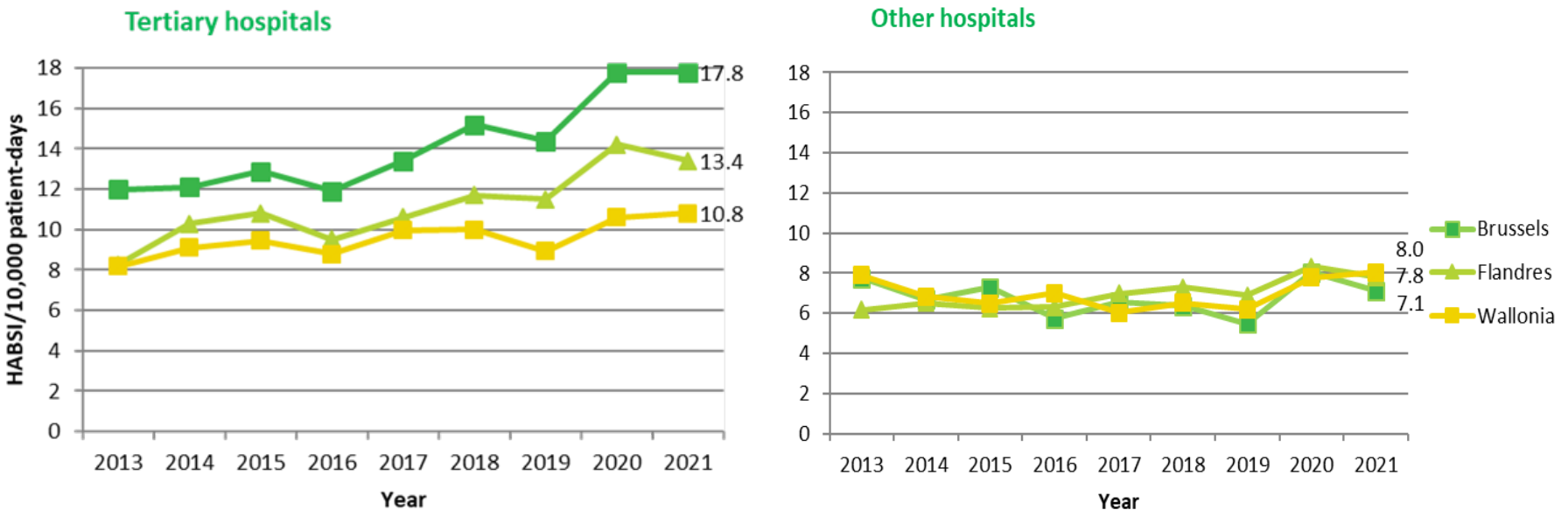

Figure 29: Mean incidence of hospital-associated bloodstream infections in tertiary and non-tertiary hospitals by region, Belgium 2013-2021 (HABSI, hospital-associated bloodstream infection)

Origin of Hospital-associated blood stream infections, Belgium - 2021

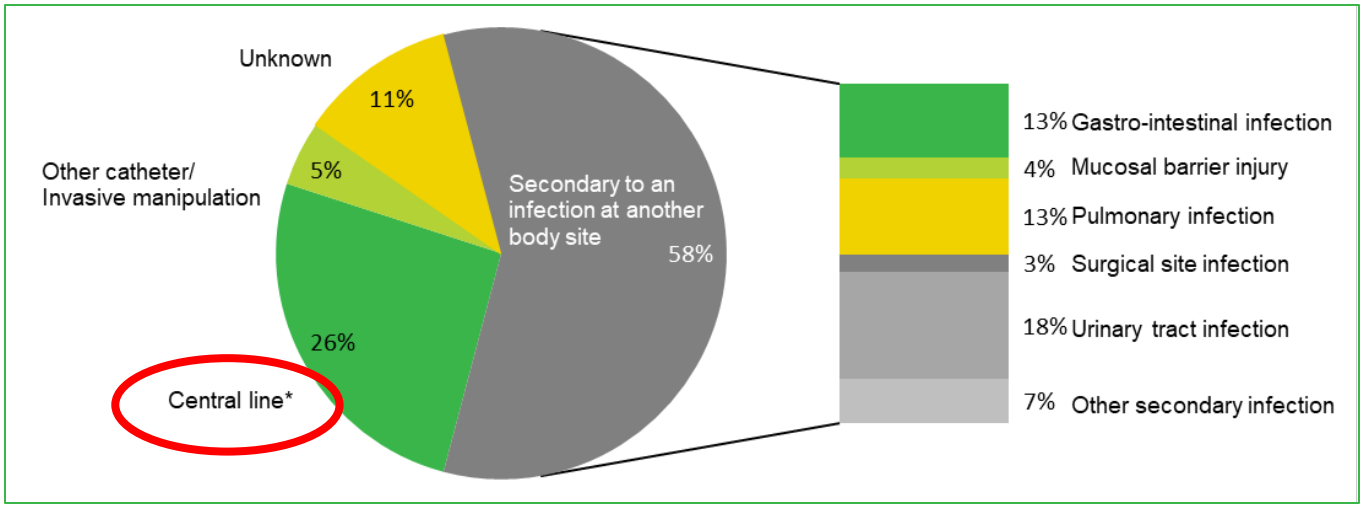

Figure 17: Sources of hospital-associated bloodstream infections, Belgium 2021
(Includes 'confirmed', 'probable' and 'possible' central line-associated bloodstream infection)*

Invasive devices

Table 1: Hospital-associated bloodstream infections associated with invasive devices, Belgium 2021

HABSI	HABSI N	HABSI %
CLABSI*	***1,963***	***100***
Confirmed (CRBSI)	715	36
Urinary tract infection	***1,404***	***100***
Urinary catheter present	659	47
Presence urinary catheter unknown	99	7
Urinary catheter as origin of HABSI is confirmed	548	39
Pulmonary infection	***997***	***100***
Endotracheal tube present	550	55
Presence endotracheal tube unknown	49	5
Endotracheal tube as origin of HABSI is confirmed	468	47
Peripheral and other catheter associated BSI	***278***	***100***
Confirmed	120	43

BSI, bloodstream infection; CLABSI, central line-associated bloodstream infection; CRBSI, central line-related bloodstream infection; HABSI, hospital-associated bloodstream infection; N, number

Note:

* Includes ‘confirmed’, ‘probable’ and ‘possible’ CLABSI

Quality indicators, 2013-2021 (Dequeker et al., in press)

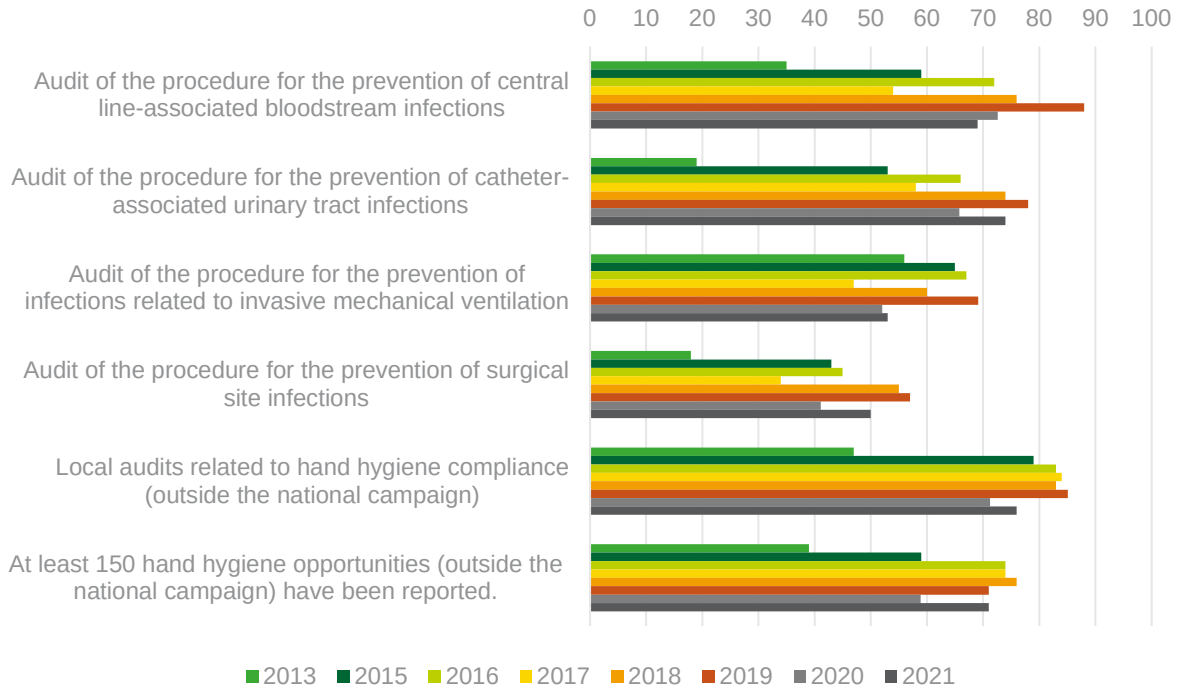

Figure 10 • Proportion of hospitals meeting the individual activity; process audits, national level, 2013 - 2021

Impact pandemic on HABSI

Similar to 2020, in 2021, compared to previous years, we found proportional more HABSI with source **pulmonary infection** (at hospital level: 2019, 11% - 2021, 13% and at ICU level: 2019, 23% - 2020, 30%) and more with **endotracheal tube present** (2019, 34% - 2020, 55%). Also in 2021 compared with the years before 2020, proportional more HABSI occurred at ICU (2019, 20% - 2021, 28%). These findings suggest that compared with the years before the COVID-19 pandemic, there were proportionally more critical ill patients with a HABSI.

In 2021, we did not observe a change in trend of MO specific HABSI incidences and antimicrobial resistance profile of selected causal MO. Also the 2021 crude mortality for HABSI (20%) remained similar to previous years.

Hospital surveillance of COVID-19 in Belgium

The surveillance of COVID-19 hospitalized patients is based on 2 components:

- The Surge Capacity Surveillance: This surveillance collects daily aggregated information on COVID-19: such as number of hospital admissions, hospital discharges, hospital-wide and intensive care unit (ICU) bed occupancy, and mortality. Reporting to this surveillance is **compulsory**. Its aim is to describe the occupancy levels of hospitals and intensive care by patients with COVID-19.

- The Clinical Hospital Surveillance: This surveillance collects clinical data on patient level upon hospital admission, hospital discharge and ICU discharge. These data are collected in three separate forms. The ICU discharge form was only implemented from the 14th of September 2020. The aim of this **voluntary** surveillance is to study the demographics and outcomes of hospitalized patients with COVID-19 infection.

COVID-19 CLINICAL HOSPITAL SURVEILLANCE REPORT
March 2020 – January 2021

Hospital wide

Table 2: Complications among all hospitalized patients.[5]

Complications	0-19	20-49	50-79	80+	All patients
Acute coronary syndrome	1 (0.2 %)	5 (0.2 %)	91 (1.1 %)	106 (1.9 %)	203 (1.2 %)
Altered consciousness	1 (0.2 %)	11 (0.5 %)	353 (4.2 %)	492 (9 %)	857 (5.2 %)
Pulmonary embolism	1 (0.2 %)	35 (1.5 %)	254 (3 %)	96 (1.8 %)	386 (2.3 %)
Hepatic hypoxia	0 (0 %)	8 (0.4 %)	73 (0.9 %)	25 (0.5 %)	106 (0.6 %)
Acute kidney injury	1 (0.2 %)	49 (2.2 %)	904 (10.8 %)	813 (14.9 %)	1767 (10.7 %)
MOF	0 (0 %)	12 (0.5 %)	209 (2.5 %)	119 (2.2 %)	340 (2.1 %)
Sepsis	2 (0.5 %)	29 (1.3 %)	372 (4.4 %)	189 (3.5 %)	592 (3.6 %)
Shock	1 (0.2 %)	18 (0.8 %)	269 (3.2 %)	92 (1.7 %)	380 (2.3 %)
Stroke	0 (0 %)	1 (0 %)	69 (0.8 %)	45 (0.8 %)	115 (0.7 %)

Table 3: Severity indicators (all hospitalized patients).[6]

Severity	Number (%)
Pneumonia based on medical imaging (CT or Xray)	20025 (77.5 %)
Bacterial or fungal superinfection	5063 (18.4 %)
ARDS	3367 (12.2 %)
Transferred to ICU	3400 (12.0 %)

Table 4: Case fatality rate (CFR) per age group (all hospitalized patients).

	Number (%)
0-19	1 (0.2 %)
20-49	61 (1.5 %)
50-79	2201 (15.1 %)
80+	3308 (36.4 %)

Intensive care units

Table 7: Complications among all intensive care patients, stratified by use of invasive ventilation.[9]

Complications	Not invasively ventilated	Invasively ventilated
Acute coronary syndrome	23 (1.6 %)	36 (1.9 %)
Altered consciousness	47 (3.2 %)	110 (5.9 %)
Pulmonary embolism	34 (2.3 %)	48 (2.6 %)
Hepatic hypoxia	10 (0.7 %)	49 (2.7 %)
Acute kidney injury	131 (9 %)	352 (19 %)
MOF	13 (0.9 %)	168 (9.1 %)
Sepsis	46 (3.2 %)	245 (13.3 %)
Shock	14 (1 %)	220 (11.9 %)
Stroke	13 (0.9 %)	23 (1.2 %)

Table 8: Severity indicators (ICU patients).[10]

Severity	Number (%)
Bacterial or fungal superinfection	1426 (41.9 %)
ARDS	1744 (51.4 %)
Invasive ventilation	1849 (54.4 %)
ECMO	146 (4.3 %)

Table 9: Case fatality rate (CFR) per age group (ICU patients).

	Number (%)
0-19	1 (5.3 %)
20-49	39 (8.7 %)
50-79	931 (37.7 %)
80+	310 (66.7 %)

R. DE PAUW, B. SERRIEN, N. VAN GOETHEM, D. VAN BECKHOVEN, K. BLOT, January 2021

What proportion of COVID-19 is nosocomial?

To estimate the proportion of **nosocomial COVID-19 infections in the Belgian hospitals** since the start of the pandemic, as well as the main characteristics of patients involved.

Surveillance data were extracted from the voluntary Clinical Hospital Surveillance established by Sciensano (ca **66% coverage** of all hospitalized COVID-19 patients in Belgium), from the period of the 14th of March 2020 to the 28th of March 2021 (n patients =51,293).

European Centres for Disease Control and Prevention (ECDC) definitions for nosocomial SARS-cov2 were applied;

out-of-hospital: <=d2;

indeterminate: d3 to d7,

probably nosocomial: d8-d14,

definitely nosocomial: > d14 after admission.

Multivariate logistic regression was used to identify risk factors for mortality.

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Results clinical presentation inpatients

Inclusion criteria (admission date, date of diagnosis and/or onset of symptoms*) were met for **49,623 patients** (median age 72, IQR 57-83) out of 51,293.

*!whichever came first - no adjustments for Se/Sp RT-PCR/CT Thorax

Out of the dataset 22,445 observations

- 10,152 (45.23%) were tested due to **symptoms** indicative of a **COVID-19** infection,
- 7,868 (15.86%) were tested due to systematic **screening**,
- 1,042 (2.1%) were tested for reasons described in the survey as '**other**',
- 18,268 (36.81%) the reason for testing was considered as '**unknown**' or not filled in.

Clinical presentation

- 7,076 observations (14.26%) were considered **asymptomatic**
- 23,533 (**47.42%**) had **fever-related** symptoms
- 3,819 (7.7%) had **upper respiratory** symptoms
- 30,782 (**62.03%**) had **lower respiratory** symptoms
- 2,656 (5.35%) had **anosmia** symptoms
- 11,147 (22.46%) had **gastro-intestinal** symptoms
- 11,147 (22.46%) had symptoms associated with a **viral syndrome**.

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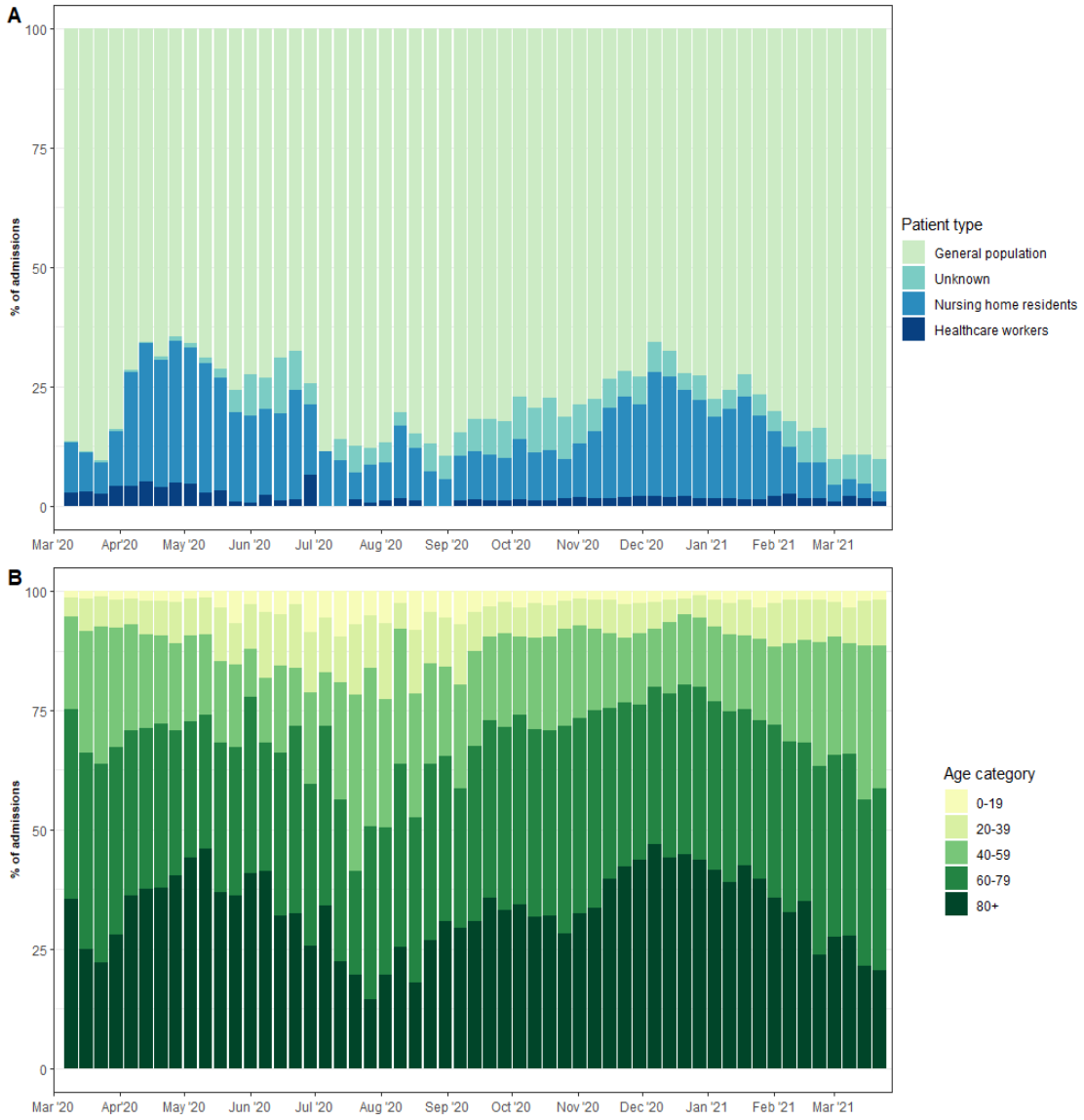
IQR: interquartile range, RT-PCR: Reverse transcription polymerase chain reaction, Se/Sp: sensitivity/specificy, CT: computed tomography

A. Percentage of all admissions per patient type.

B. Percentage of all admissions grouped per age category.



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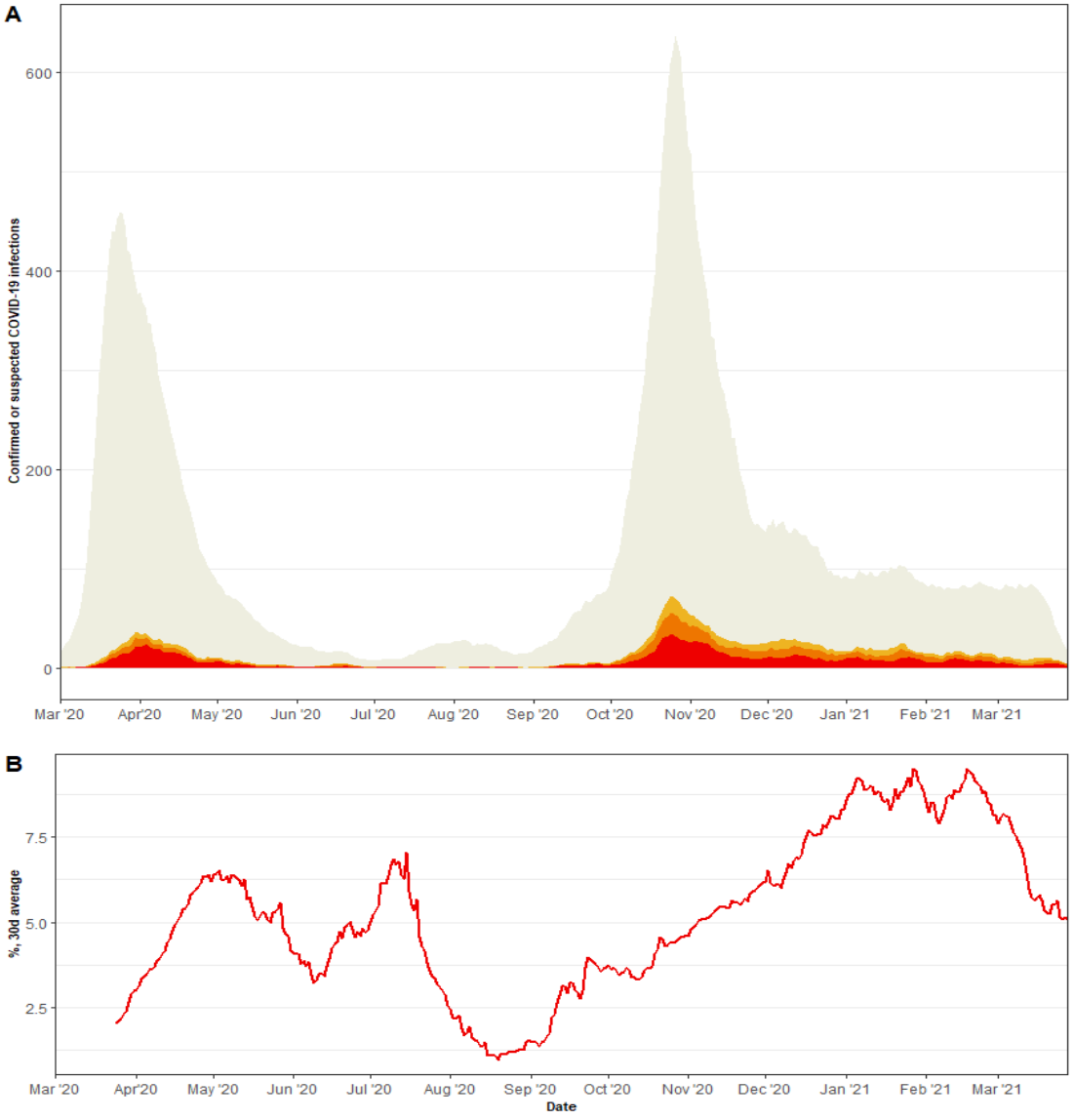
A. Evolution of confirmed or suspected COVID-19 cases in the CHS , dates grouped by day of first confirmation, cases grouped by suspected origin of infection.

B. Evolution of percentage of definitely nosocomial cases in all confirmed or suspected COVID-19 cases in the Clinical Hospital Surveillance, 30 days rolling average.



Compared to UK:
(Read e.a., 2021 Lancet)
11.3%

11.1%

5.3%

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Results logistic regression mortality

The **odds ratio of dying during hospital stay**, **nosocomial** (probably + definitely) to out-of-hospital, for the entire studied population was **1.62**, with 95% confidence interval [1.50 - 1.75].

The odds ratio for patients dying

aged 0-19 was 0 [0 - +Inf],

aged 20-39 was 3.29 [0.77 - 14.00],

aged 40-59 was 3.13 [2.18 - 4.50],

aged 60-79 was 1.5 [1.32 - 1.71],

aged 80 or older was 0.92 [0.83 - 1.01].

CAVEAT: no adjustements for comorbidities

Mortality due to nosocomial COVID-19

Systematic review & meta-analysis

21 studies, 8,251 admissions, 8 countries

“Nosocomial compared to community acquired COVID-19”

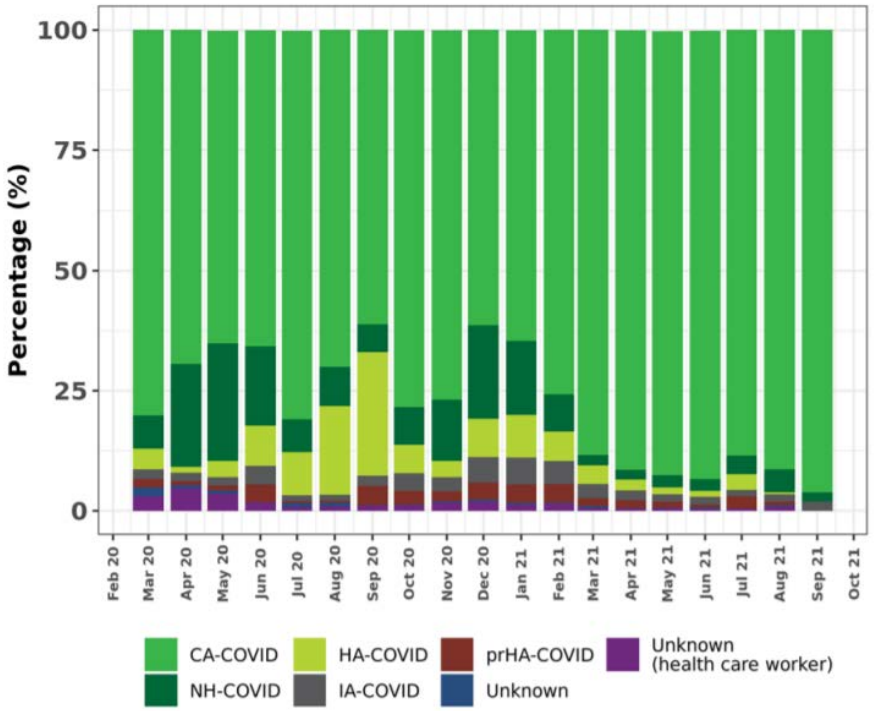
- Definition varied (treshold 14 days, 8, 6 ….) and ‘accepted’.

- Odd’s Ratio 1.3 (95% CI 1.005-1.683)
- Immunosupression (Relative Risk 2.14, 95% CI 1.76-2.61)

Ponsford et al., 2021 Frontiers in Immunology

Available reports & dashboard:
https://covid-19.sciensano.be/nl/covid-19-epidemiologische-situatie
https://epistat.wiv-isp.be/covid/covid-19.html

Figure 13: Distribution of healthcare associated COVID-19 infection (all hospitalized patients), per week.



Time-to-infection after hospitalization was defined as days between hospital admission and date of symptom onset. In a small minority of cases the date of symptom onset was missing, in which case the date of diagnosis was used instead.

- CA-COVID: Community-associated COVID: up to 2 days after admission.
- NH-COVID: Nursing home-associated COVID: nursing home resident with symptom onset up to 2 days after admission.
- HA-COVID: Definite healthcare-associated COVID infection: >14 days after admission.
- prHA-COVID: Probable HA-COVID: on days 8-14 after admission.
- IA-COVID: Indeterminate-association COVID: on days 3-7 after admission.

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https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_Hospital_epidemiology_Part_1.pdf

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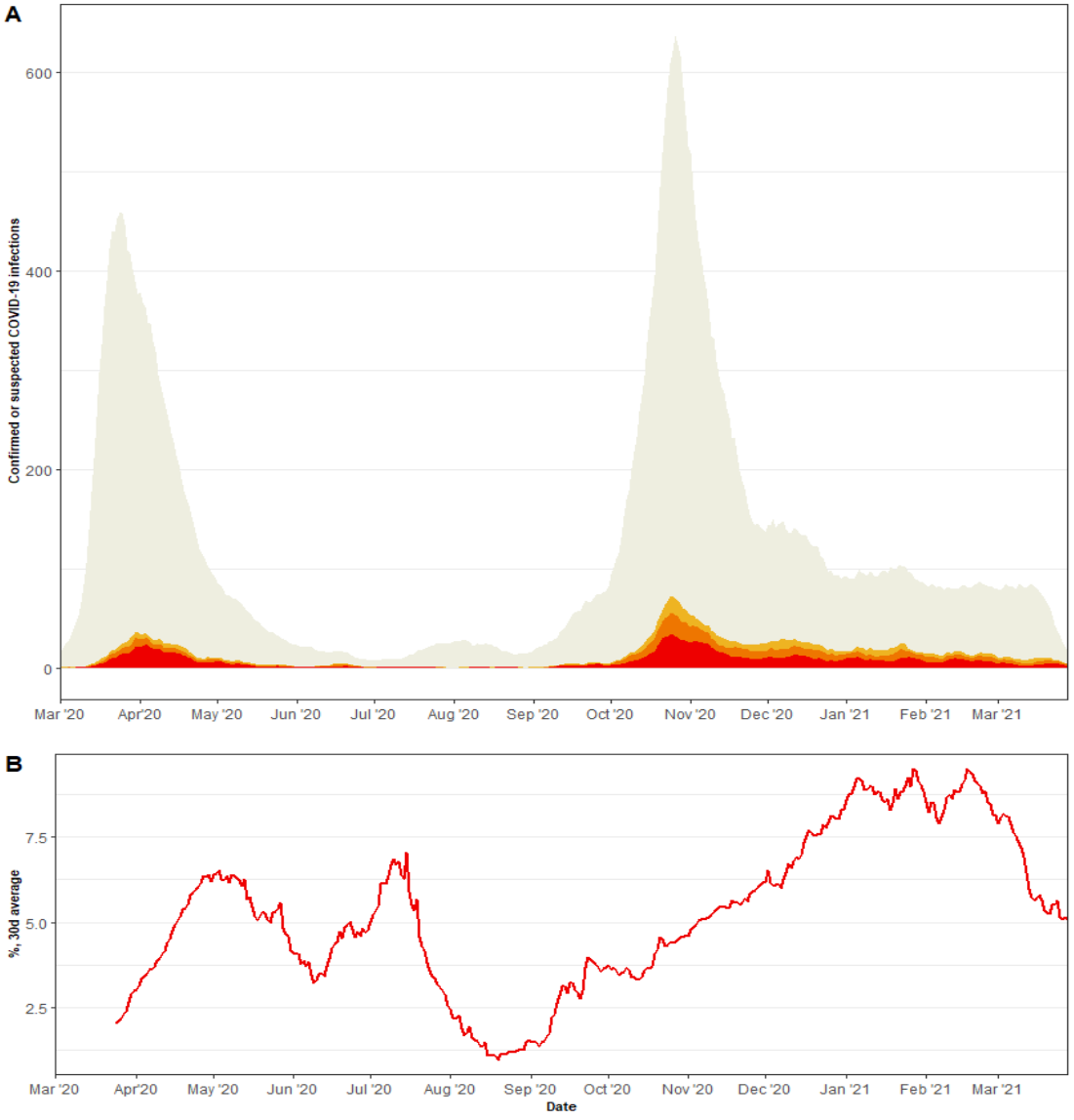
A. Evolution of confirmed or suspected COVID-19 cases in the CHS , dates grouped by day of first confirmation, cases grouped by suspected origin of infection.

B. Evolution of percentage of definitely nosocomial cases in all confirmed or suspected COVID-19 cases in the Clinical Hospital Surveillance, 30 days rolling average.



Read e.a., 2021 Lancet
11.3%

11.1%

5.3%

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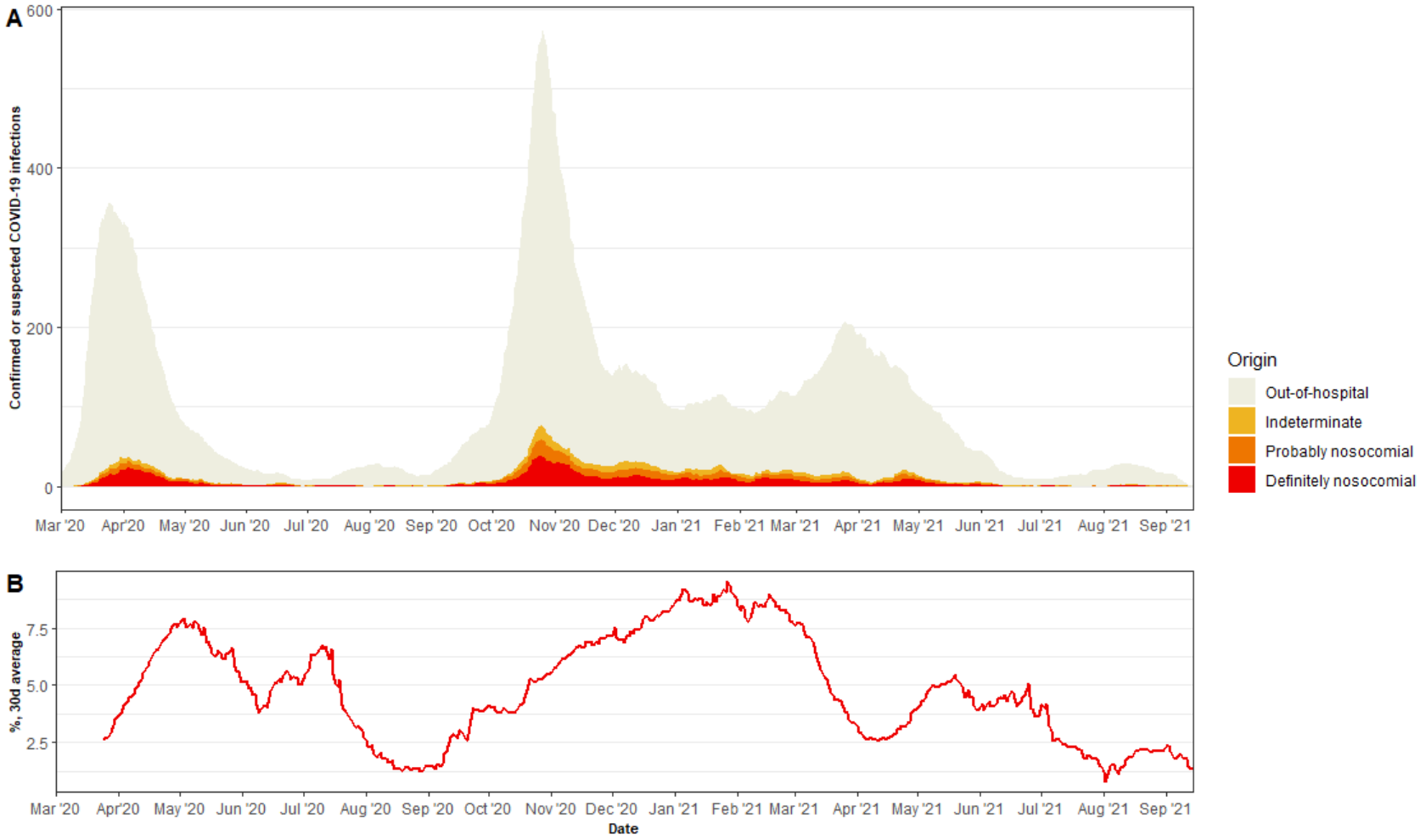
Claes et al., 2021 ARIC

Treshold >14 days (ECDC definitions)



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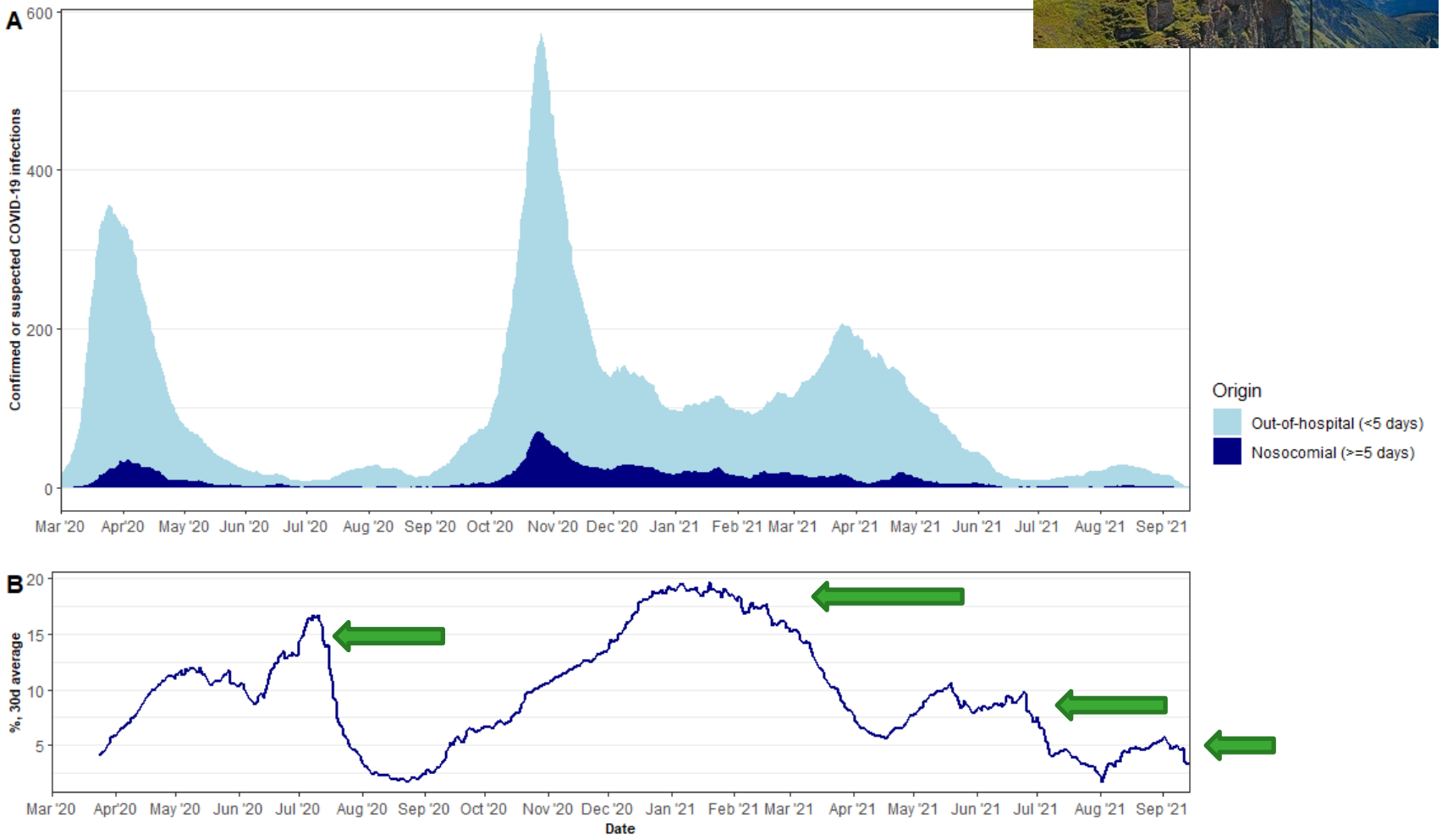
Treshold: >=5d post admission

(He et al., 2020 Nature Medecine; Karan et al., 2021 CID)



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"After-peak HAI burden" also applicable in a post vaccination area

Intensive care units, Belgium 2021

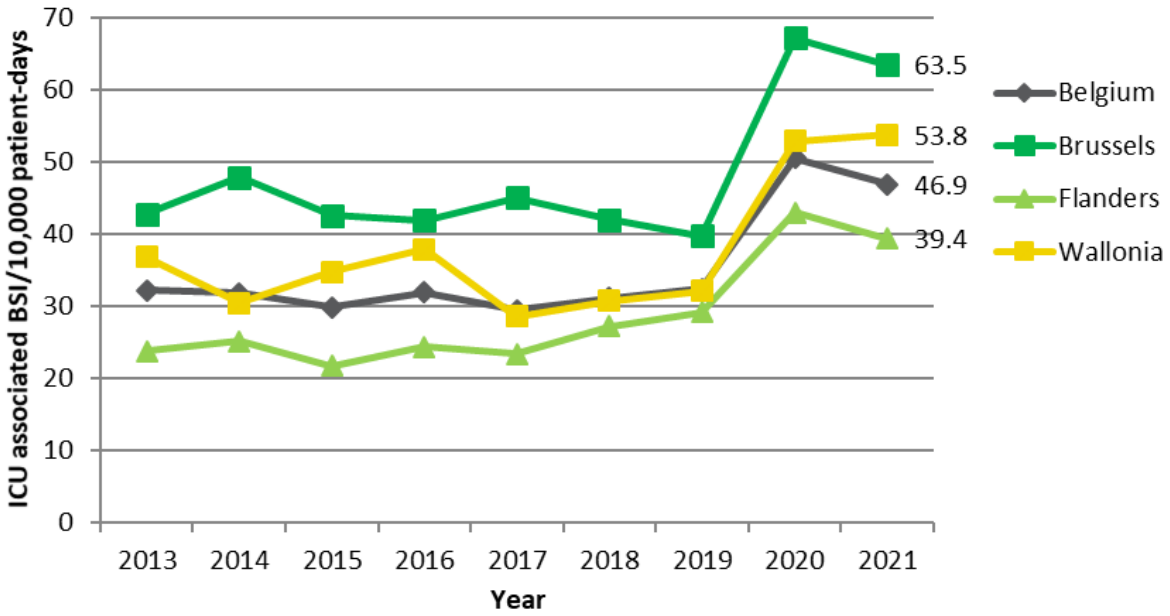

Figure 1: Mean incidence of intensive care unit-associated bloodstream infections, by region, Belgium 2013-2021 (BSI, bloodstream infections; ICU, intensive care unit)

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COVID-19 CLINICAL HOSPITAL SURVEILLANCE REPORT
March 2020 – January 2021

Hospital wide

Table 2: Complications among all hospitalized patients.[5]

Complications	0-19	20-49	50-79	80+	All patients
Acute coronary syndrome	1 (0.2 %)	5 (0.2 %)	91 (1.1 %)	106 (1.9 %)	203 (1.2 %)
Altered consciousness	1 (0.2 %)	11 (0.5 %)	353 (4.2 %)	492 (9 %)	857 (5.2 %)
Pulmonary embolism	1 (0.2 %)	35 (1.5 %)	254 (3 %)	96 (1.8 %)	386 (2.3 %)
Hepatic hypoxia	0 (0 %)	8 (0.4 %)	73 (0.9 %)	25 (0.5 %)	106 (0.6 %)
Acute kidney injury	1 (0.2 %)	49 (2.2 %)	904 (10.8 %)	813 (14.9 %)	1767 (10.7 %)
MOF	0 (0 %)	12 (0.5 %)	209 (2.5 %)	119 (2.2 %)	340 (2.1 %)
Sepsis	2 (0.5 %)	29 (1.3 %)	372 (4.4 %)	189 (3.5 %)	592 (3.6 %)
Shock	1 (0.2 %)	18 (0.8 %)	269 (3.2 %)	92 (1.7 %)	380 (2.3 %)
Stroke	0 (0 %)	1 (0 %)	69 (0.8 %)	45 (0.8 %)	115 (0.7 %)

Table 3: Severity indicators (all hospitalized patients).[6]

Severity	Number (%)
Pneumonia based on medical imaging (CT or Xray)	20025 (77.5 %)
Bacterial or fungal superinfection	5063 (18.4 %)
ARDS	3367 (12.2 %)
Transferred to ICU	3400 (12.0 %)

Table 4: Case fatality rate (CFR) per age group (all hospitalized patients).

	Number (%)
0-19	1 (0.2 %)
20-49	61 (1.5 %)
50-79	2201 (15.1 %)
80+	3308 (36.4 %)

Intensive care units

Table 7: Complications among all intensive care patients, stratified by use of invasive ventilation.[9]

Complications	Not invasively ventilated	Invasively ventilated
Acute coronary syndrome	23 (1.6 %)	36 (1.9 %)
Altered consciousness	47 (3.2 %)	110 (5.9 %)
Pulmonary embolism	34 (2.3 %)	48 (2.6 %)
Hepatic hypoxia	10 (0.7 %)	49 (2.7 %)
Acute kidney injury	131 (9 %)	352 (19 %)
MOF	13 (0.9 %)	168 (9.1 %)
Sepsis	46 (3.2 %)	245 (13.3 %)
Shock	14 (1 %)	220 (11.9 %)
Stroke	13 (0.9 %)	23 (1.2 %)

Table 8: Severity indicators (ICU patients).[10]

Severity	Number (%)
Bacterial or fungal superinfection	1426 (41.9 %)
ARDS	1744 (51.4 %)
Invasive ventilation	1849 (54.4 %)
ECMO	146 (4.3 %)

Table 9: Case fatality rate (CFR) per age group (ICU patients).

	Number (%)
0-19	1 (5.3 %)
20-49	39 (8.7 %)
50-79	931 (37.7 %)
80+	310 (66.7 %)

R. DE PAUW, B. SERRIEN, N. VAN GOETHEM, D. VAN BECKHOVEN, K. BLOT, January 2021

Concluding remarks on acute care hospitals

Increase in HABSI and CLABSI incidence

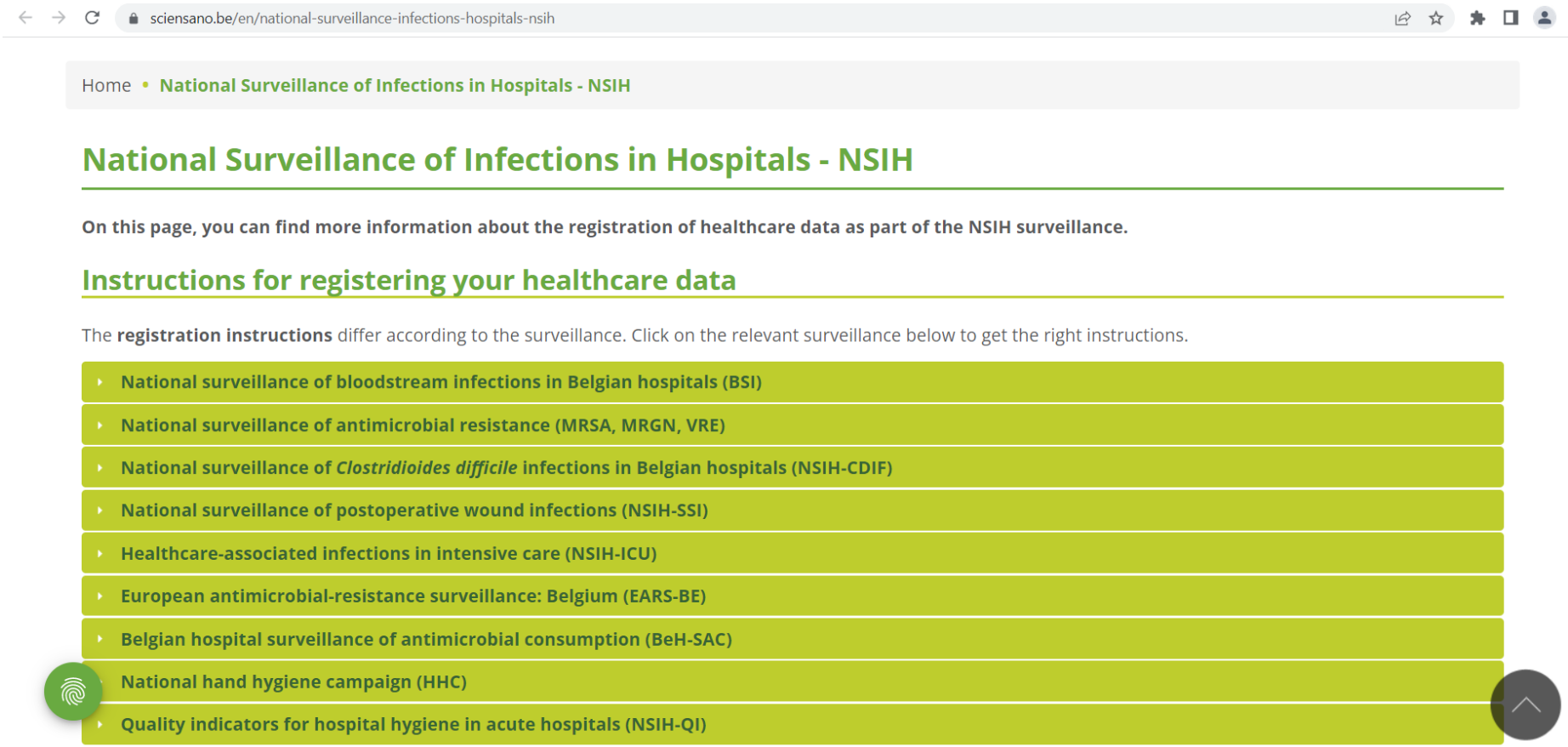
- Heavy working conditions and critical ill patients at admission ➔ fatigue with poorer infection prevention and control (e.g. CLABSI bundle requirements)
- Different patient population due to COVID-19 ➔ delayed care and stopping elective/routine care ➔ more severe ill and weaker patients at admission ➔ weaker immunity system ➔ more susceptible to develop HABSI

Proportion of **COVID-19 cases** in healthcare-associated infections is substantial but difficult to compare with those caused by bacteria (treshold wise a.o.). – Immunosuppression is key risk factor

Let us first recover

List of projects & updates

https://www.sciensano.be/en/national-surveillance-infections-hospitals-nsih



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The NSIH team: Karl, Katrien, Lucy, Kat, Els, Louise, Mariken, Paola, Milena, Annelies, Louise, Matijs, Laura, Laura, Aline, Nathalie, Sara, Laure, Moira, Gael, Helene, Nathalie

ECDC, BAPCOC, Healthdata, VIKZ, PAQS, AZG, AVIC, Ostbelgien, CoCom, VITO, HGR, RIZIV/INAMI, SPF/FOD Volksgezondheid, NRCs, NAC, TC-MDRO, BICS, Noso-info, GH Lux, Universities ….

The hospitals & nursing homes & laboratories, all our Sciensano colleagues

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NOSOCOMIAL[1] INFECTIONS IN CHILDREN'S WARDS

By JOYCE WRIGHT, D.M.
Department of Bacteriology, University College Hospital Medical School, London

(With 2 Figures in the Text)

In the year 1858, 2831 infants were admitted to the wards of a hospital in Prague. All succumbed, the principal causes of death being gastro-enteritis and "septicaemia". Throughout the European hospitals till late in the nineteenth century a similar tale was told, and parents feared to send their children to these institutions, where "they died, not from the malady for which they entered the hospital, but from that which they contracted therein". To the credit of Rauchfuss (1877), of St Petersburg, and of Grancher (1888) and Hutinel (1894), of Paris, lie the first attempts, towards the end of the nineteenth century, to introduce sanitary measures into children's wards and to provide isolation facilities for the detection of infectious disease among hospital entrants. A marked reduction in mortality ensued, in one hospital, for example, from 40 to 8%. General improvement in public-health measures, resulting in a bacteriologically purer water and milk supply, the realization of the practical implications of the "carrier" as a vehicle of infection, etc., reduced still further the incidence of nosocomial disease, particularly that due to gastro-intestinal infection. But a residual risk remains to-day, particularly with regard to respiratory disease. As McKhann, Steeger & Long (1938) state, "the problem of cross-infection in an infants' hospital is not so much a question of controlling gastro-intestinal and so-called contagious disease as one of preventing acute infections of the respiratory tract and certain ailments of the skin".

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J Hygiene (London). 1940 Dec;40(6):647-72. doi: 10.1017/s002217240002814x.

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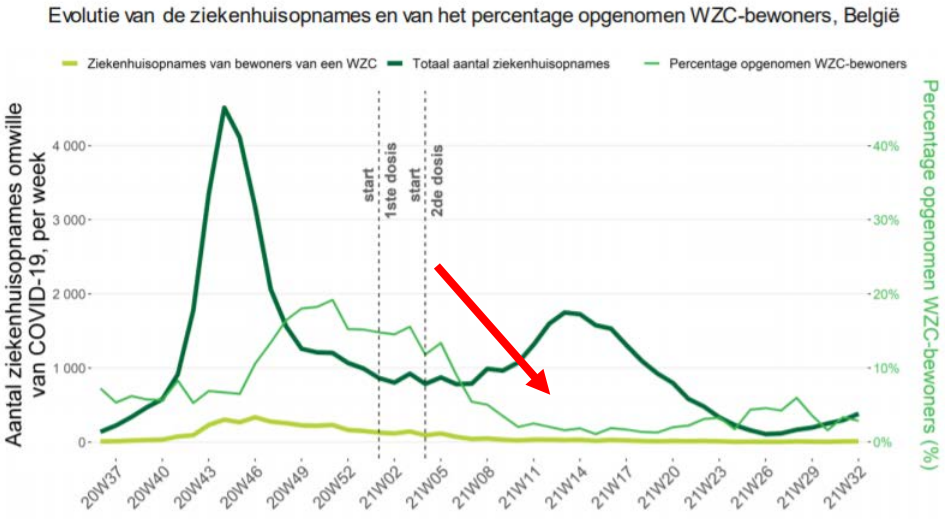
Vaccination & hospitalisation update

Hospitalised patients	2e wave	3e wave
Resident Nursing home	11.4%	2.4%
Healthcare worker	1.5%	0.6%
COVID-19 definitely nosocomial*	6.7%	2.7%

Priority groups for vaccination were less frequently hospitalised during the 3e wave



Percentage **hospitalised patients from nursing homes** declines since the start of the vaccination campaign (Jan 2021)

**infection, >14d after hospital admission*

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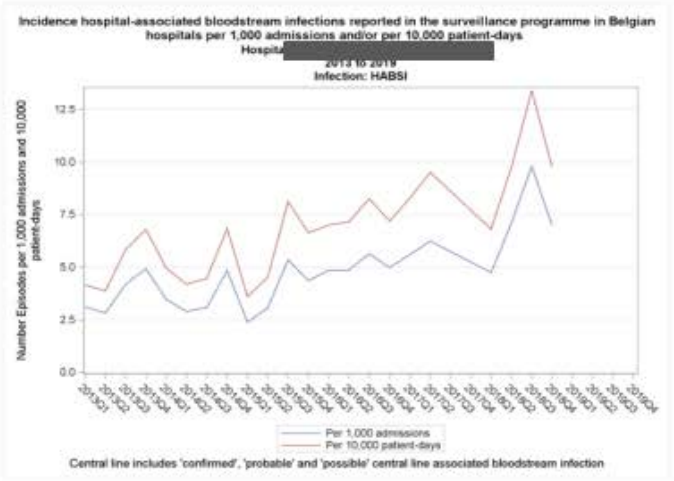
BSI reports on Healthstat.be

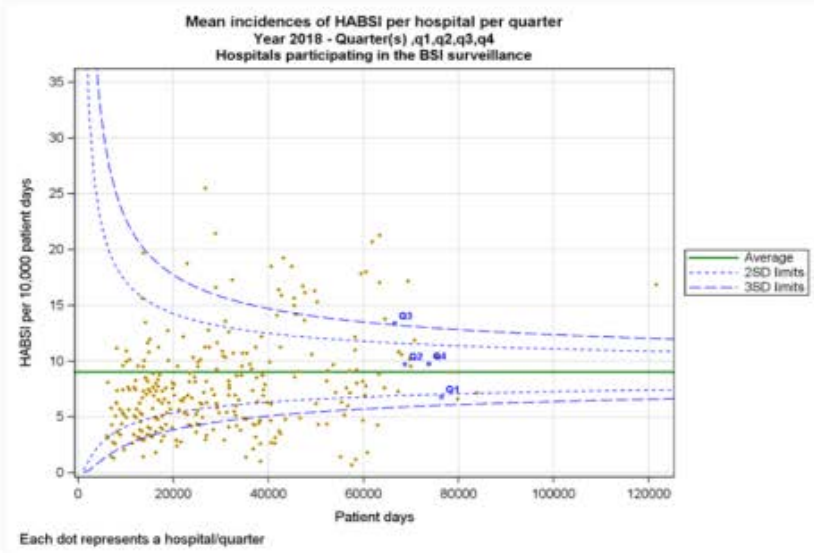


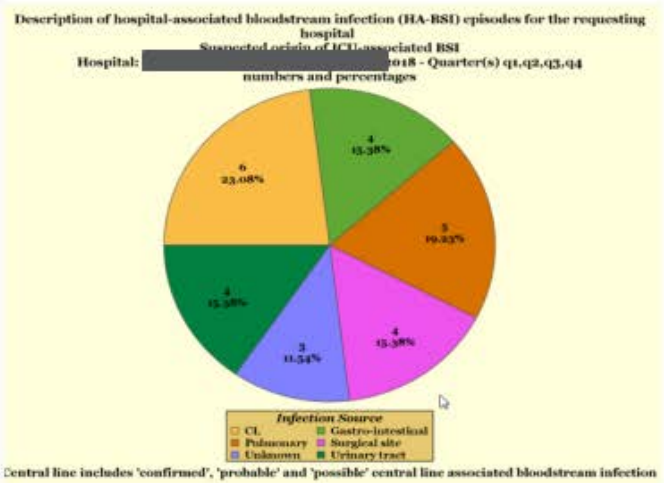
Incidence hospital-associated bloodstream infections reported in the surveillance programme in Belgian hospitals

Hospita[redacted]

2013 to 2019

Infection			N	N admissions	N/1,000 admissions	N patient-days	N/10,000 patient-days
CLABSI	2013	Q1	30	15,815	1.44	168,594	1.94
		Q2	12	12,813	0.94	93,180	1.29
		Q3	17	12,199	0.98	87,549	1.37
		Q4	16	13,139	1.21	95,883	1.67
	2014	Q1	10	13,572	0.74	94,836	1.05
		Q2	8	12,445	0.64	86,084	0.93
		Q3	14	12,218	1.14	85,141	1.64
		Q4	13	13,056	0.93	93,194	1.39
	2015	Q1	10	13,898	0.72	91,344	1.09
		Q2	10	12,091	0.83	81,837	1.22
		Q3	20	11,405	1.75	75,148	2.66





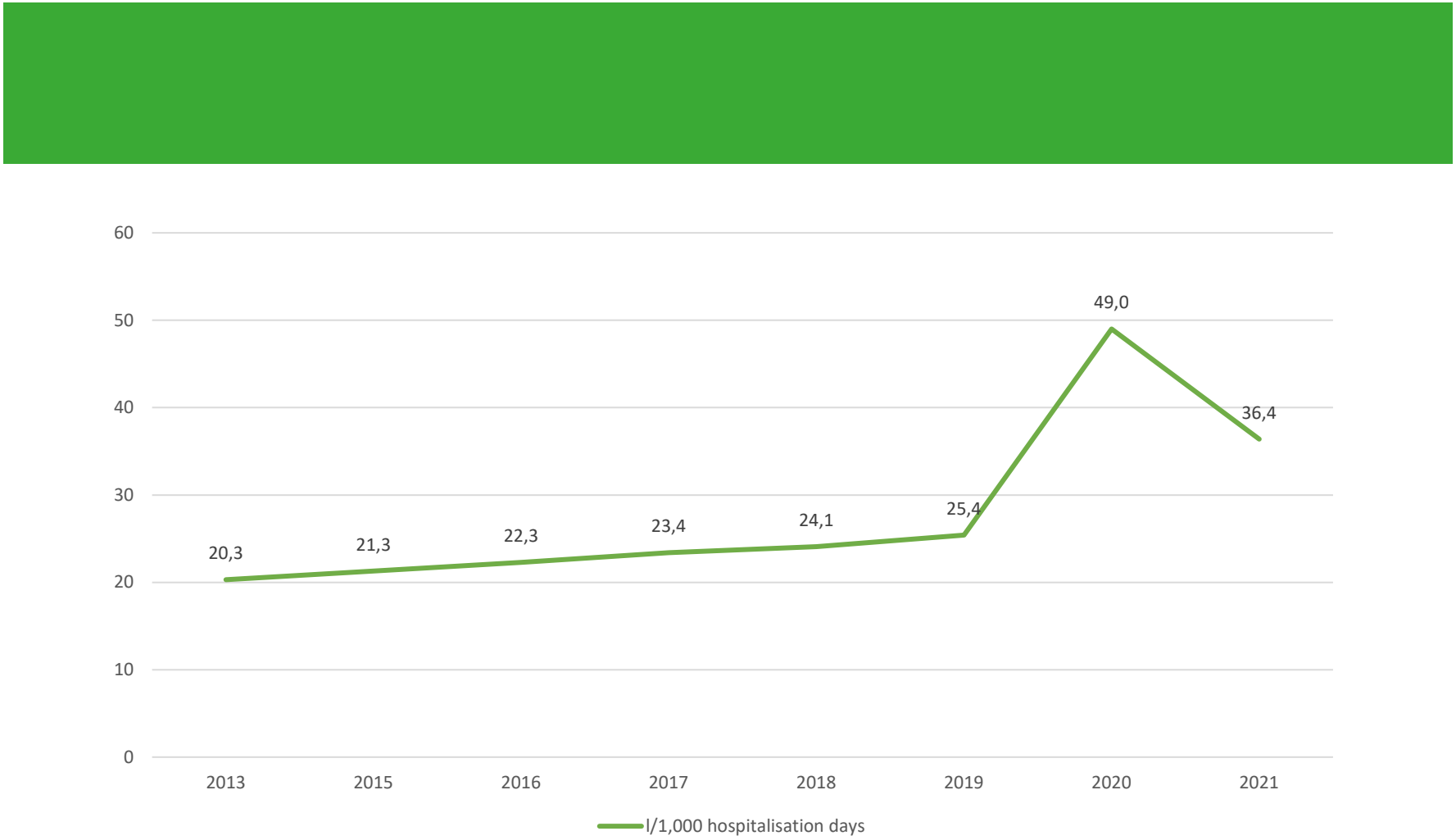


Figure 2: Alcohol-based hand rub consumption in litre per 1,000 hospitalisation days in Belgian acute care hospitals, 2013-2021

Outbreak support team(OST)

Tabel 6. Overzicht van uitbraken in 2022 in Vlaanderen waarbij uitbraakondersteuning door het OST werd verleend

Meldingsdatum	MDRO Groep	Soort bacterie *(Geslacht, soort of familie)*	Afdeling
11/10/2021	ESBL	*Klebsiella pneumoniae*	NICU
04/03/2022		*Serratia marcescens*	NICU
07/06/2022	VRE	*Enterococcus faecium*	ICU
04/08/2022	CPE (OXA-48)	*Citrobacter freundii*	Geriatrie
24/10/2022		*Serratia marcescens*	NICU

VRE: Vancomycine-resistente Enterokok; CPE: Carbapenemase-producerende Enterobacteriaceae; oxa-48: Oxacillinase-48

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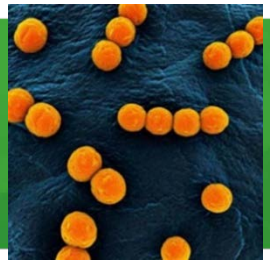
NICU: neonatal intensive care unit, ICU: intensive care unit

Vancomycine resistant enterococci



1.3 OUTBREAKS

An outbreak (i.e. at least one new secondary case within the same ward and within one month) with vanco-R enterococci was reported by 17.6% (n=16/91) of the participating hospitals in 2019. In 2020 (covid-19 year), merely 5.6% (n=5/89) of the participating hospitals reported at least one cluster. Table 10 presents the number of clusters reported and the number of patients involved between 2014 and 2020.

Table 10. Evolution of the number of outbreaks reported in the national surveillance of resistant, Belgian acute care hospitals, 2014-2020

	2014	2015	2016	2017	2018	2019	2020
N of hospitals reporting an outbreak (%)	3/40 (7.5)	7/75 (9.3)	7/95 (7.4)	13/98 (13.3)	13/96 (13.5)	16/91 (17.6)	5/89 (5.6)
N of hospitals with no answer or no type D data	0	0	1	4	13	10	14
N of clusters (min-max)	3 (1-1)	11 (1-4)	12 (1-3)	21 (1-6)	28 (1-13)	19 (1-3)*	7 (1-2)
N of patients involved	68	140	247	166	164	285	27
% patients colonised	*79.4*	*87.7*	*88.8*	*89.8*	*88.4*	*93.1*	*77.8*
% patients infected	*20.6*	*12.3*	*11.2*	*10.2*	*11.6*	*6.9*	*22.2*

*data missing for two hospitals

Table 13: Microorganisms isolated from bloodstream infections in hospitals, Belgium 2021

Microorganisms	HABSI N	HABSI %	CLABSI N	CLABSI %	Non-HABSI N	Non-HABSI %
Enterobacteriaceae	**3,380**	**41**	**382**	**18**	**905**	**54**
Escherichia coli	1,527	19	105	5	652	39
Klebsiella pneumoniae	611	7	86	4	83	5
Enterobacter cloacae	271	3	49	2	27	2
Klebsiella oxytoca	202	2	34	2	24	1
Serratia marcescens	188	2	37	2	15	1
Proteus mirabilis	138	2	6	0	31	2
Klebsiella aerogenes	96	1	14	1	8	0
Morganella morganii	70	1	8	0	10	1
Genus Klebsiella (others or not specified)	51	1	5	0	11	1
Other/not identified*	226	3	38	2	44	3
Gram-positive cocci	**3,443**	**42**	**1,367**	**65**	**563**	**33**
Staphylococcus aureus	859	10	201	10	186	11
Staphylococcus epidermidis	797	10	553	26	38	2
Enterococcus faecium	570	7	174	8	30	2
Enterococcus faecalis	496	6	141	7	59	4
Staphylococcus hominis	134	2	91	4	9	1
Staphylococcus haemolyticus	86	1	62	3	2	0
Staphylococcus capitis	71		50		2	
Streptococcus mitis group	51	1	11	1	13	1
Other/not identified*	379	5	84	4	224	13
Non-fermenting Gram-negative bacilli	**629**	**8**	**106**	**5**	**83**	**5**
Pseudomonas aeruginosa	380	5	60	3	44	3
Genus Acinetobacter (others or not specified)	68	1	16	1	4	0
Stenotrophomonas maltophilia	52		10		1	
Other/not identified*	181	2	30	1	35	2
Fungi	**449**	**5**	**190**	**9**	**20**	**1**
Candida albicans	216	3	100	5	5	0
Candida glabrata	102	1	31	1	8	0
Other/not identified*	131	2	59	3	7	0
Anaerobic bacilli	**215**	**3**	**14**	**1**	**86**	**5**
Bacteroides fragilis	71	1	6	0	28	2
Other/not identified*	144	2	8	0	58	3
Gram-positive bacilli	**48**	**1**	**20**	**1**	**14**	**1**
Gram-negative cocci	**20**	**0**	**2**	**0**	**9**	**1**
Other and not identified	**31**	**0**	**9**	**0**	**5**	**0**
Total	**8,215**	**100**	**2,090**	**100**	**1,685**	**100**

BSI, bloodstream infection; HABSI, hospital-associated bloodstream infection; n, number

Note:

* Other includes microorganisms causing among the HABSI reported in the 2020 surveillance <50 episodes of HABSI/year

Overall reported microorganisms in hospital-associated blood stream infections, Belgium 2000-2021

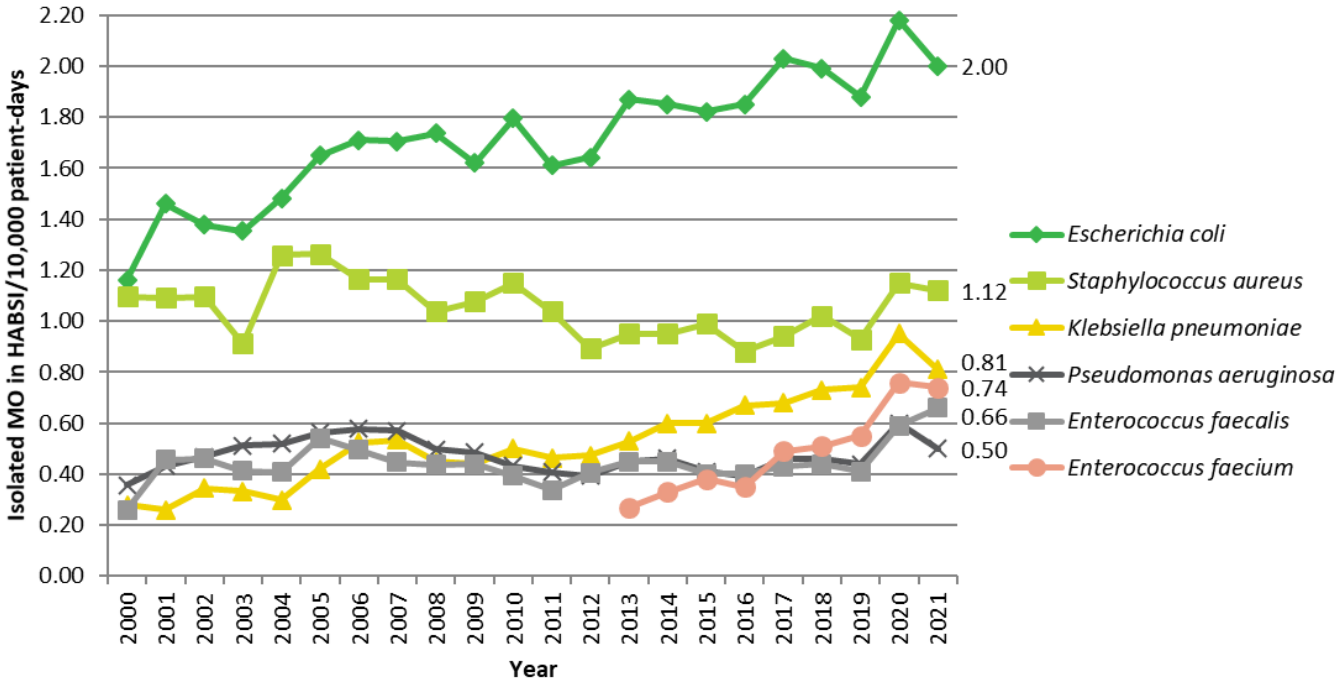


Figure 7: Mean incidence of hospital-associated bloodstream infections per microorganism, Belgium 2000-2021 (HABSI, hospital-associated bloodstream infection; MO, microorganism)

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Central line reported microorganisms in Blood stream infectons, Belgium ’13-’21

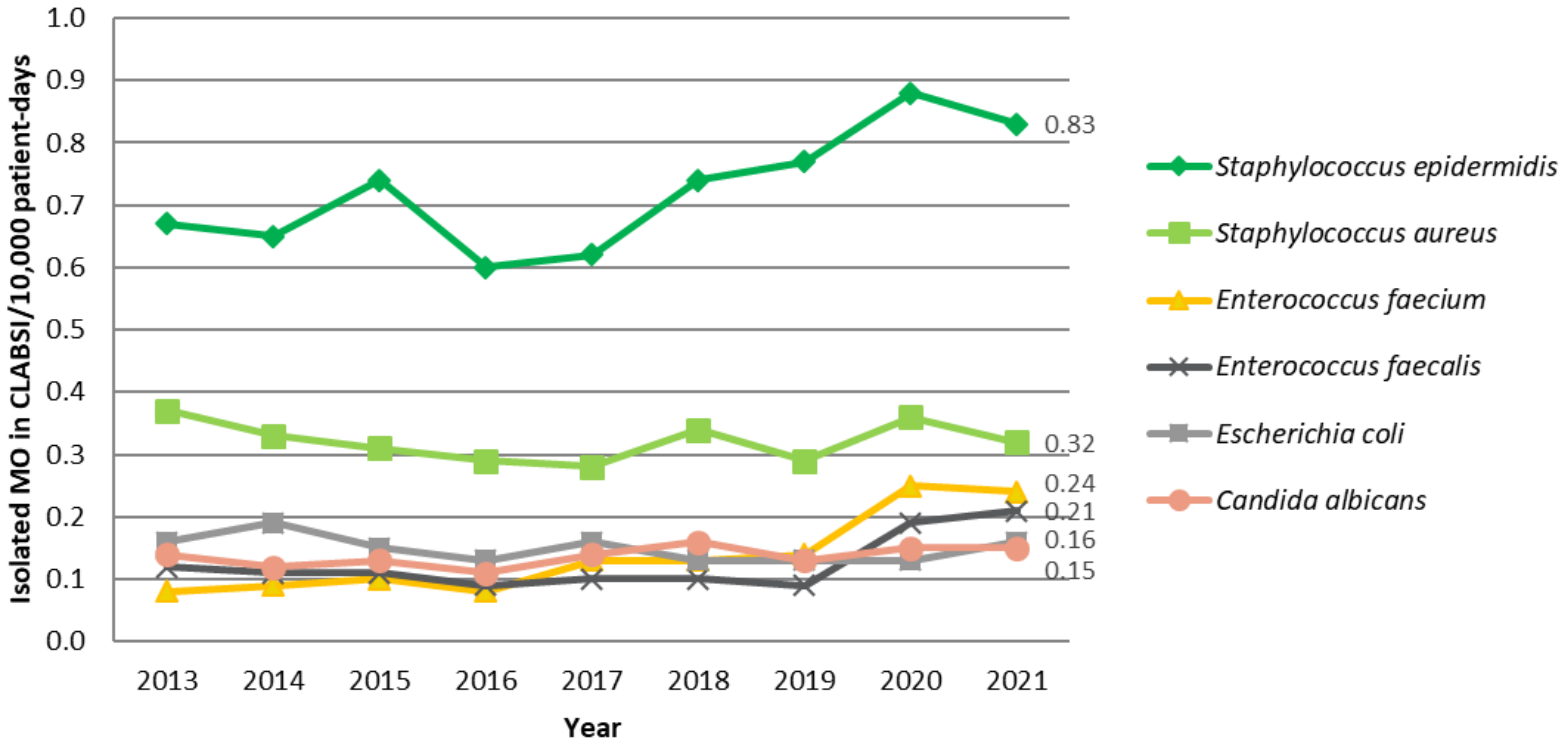

Figure 1: Mean incidence of central line-associated bloodstream infections per microorganism, Belgium 2013-2021 (CLABSI, central line-associated bloodstream infection; MO, microorganism)

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Disability adjusted life years, AMR BE

Belgium: Estimated number of disability-adjusted life-years (DALYs) due to infections with antibiotic-resistant bacteria, EU/EEA, 2016-2020 (by decreasing number of DALYs in 2020)

	2016	2017	2018	2019	2020
Third-generation cephalosporin-resistant *E. coli*	7 267 (6 611 - 7 959)	8 724 (7 980 - 9 490)	8 098 (7 390 - 8 832)	9 113 (8 361 - 9 889)	6 879 (6 294 - 7 480)
Third-generation cephalosporin-resistant *K. pneumoniae*	3 381 (3 181 - 3 593)	2 815 (2 635 - 3 007)	3 769 (3 538 - 4 019)	3 892 (3 665 - 4 129)	3 115 (2 929 - 3 314)
Meticillin-resistant *S. aureus*	4 827 (4 465 - 5 219)	3 377 (3 113 - 3 666)	4 374 (3 987 - 4 806)	2 592 (2 388 - 2 817)	2 497 (2 309 - 2 703)
Carbapenem-resistant *P. aeruginosa*	1 997 (1 576 - 2 455)	1 843 (1 410 - 2 349)	1 779 (1 363 - 2 246)	2 863 (2 188 - 3 661)	2 470 (1 938 - 3 090)
Penicillin-non-wild-type and macrolide-resistant *S. pneumoniae*	77 (62 - 106)	41 (33 - 56)	0 (0 - 0)	1 596 (1 464 - 1 758)	1 234 (1 146 - 1 342)
Penicillin-non-wild-type *S. pneumoniae*	0 (0 - 0)	4 (3 - 5)	0 (0 - 0)	1 274 (1 169 - 1 423)	999 (920 - 1 103)
Vancomycin-resistant *E. faecalis / E. faecium*	181 (155 - 219)	1 007 (902 - 1 134)	234 (194 - 284)	310 (262 - 382)	537 (484 - 604)
Carbapenem-resistant *K. pneumoniae*	869 (713 - 1 025)	362 (290 - 435)	574 (475 - 673)	291 (227 - 358)	286 (220 - 359)
Multidrug-resistant *P. aeruginosa*	176 (102 - 275)	334 (228 - 465)	260 (149 - 412)	265 (189 - 361)	240 (165 - 332)
Carbapenem-resistant *Acinetobacter* spp.	137 (81 - 200)	438 (312 - 570)	137 (96 - 180)	0 (0 - 0)	36 (20 - 55)
Carbapenem-resistant *E. coli*	104 (69 - 142)	62 (37 - 89)	166 (112 - 223)	225 (134 - 320)	21 (12 - 30)
Aminoglycoside- and fluoroquinolone-resistant *Acinetobacter* spp.	0 (0 - 0)	82 (38 - 132)	61 (29 - 98)	0 (0 - 0)	12 (6 - 20)
Overall	19 016 (17 015 - 21 193)	19 089 (16 981 - 21 398)	19 452 (17 333 - 21 773)	22 421 (20 047 - 25 098)	18 326 (16 443 - 20 432)

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Number of selected infections, AMR BE

Belgium: Estimated number of infections with antibiotic-resistant bacteria, 2016-2020 (by decreasing number of infections in 2020)

	2016	2017	2018	2019	2020
Third-generation cephalosporin-resistant *E. coli*	7 056 (6 117 - 8 101)	7 922 (6 915 - 9 019)	7 294 (6 380 - 8 279)	7 869 (6 895 - 8 961)	6 171 (5 401 - 7 012)
Third-generation cephalosporin-resistant *K. pneumoniae*	2 726 (2 443 - 3 026)	2 788 (2 472 - 3 127)	3 575 (3 183 - 3 991)	3 037 (2 705 - 3 399)	2 689 (2 395 - 3 007)
Meticillin-resistant *S. aureus*	4 296 (3 716 - 4 933)	3 230 (2 774 - 3 725)	3 953 (3 385 - 4 579)	2 250 (1 940 - 2 594)	2 106 (1 833 - 2 412)
Carbapenem-resistant *P. aeruginosa*	1 134 (919 - 1 384)	1 189 (936 - 1 488)	1 033 (816 - 1 284)	1 700 (1 338 - 2 116)	1 513 (1 207 - 1 878)
Vancomycin-resistant *E. faecalis / E. faecium*	228 (152 - 333)	1 201 (912 - 1 543)	441 (285 - 640)	353 (238 - 536)	517 (375 - 693)
Penicillin-non-wild-type and macrolide-resistant *S. pneumoniae*	11 (9 - 17)	6 (5 - 8)	0 (0 - 0)	505 (469 - 547)	403 (374 - 438)
Penicillin-non-wild-type *S. pneumoniae*	0 (0 - 0)	6 (5 - 8)	0 (0 - 0)	368 (341 - 401)	267 (246 - 291)
Multidrug-resistant *P. aeruginosa*	96 (59 - 145)	218 (159 - 288)	185 (112 - 290)	216 (158 - 288)	156 (112 - 210)
Carbapenem-resistant *K. pneumoniae*	209 (176 - 245)	113 (92 - 139)	164 (137 - 193)	101 (79 - 129)	104 (79 - 137)
Carbapenem-resistant *Acinetobacter* spp.	43 (33 - 56)	188 (148 - 231)	104 (81 - 130)	0 (0 - 0)	34 (23 - 48)
Aminoglycoside- and fluoroquinolone-resistant *Acinetobacter* spp.	0 (0 - 0)	20 (12 - 33)	41 (23 - 65)	0 (0 - 0)	17 (10 - 27)
Carbapenem-resistant *E. coli*	36 (25 - 50)	17 (10 - 27)	52 (36 - 73)	39 (24 - 62)	14 (9 - 23)
Overall	15 835 (13 649 - 18 290)	16 898 (14 440 - 19 636)	16 842 (14 438 - 19 524)	16 438 (14 187 - 19 033)	13 991 (12 064 - 16 176)

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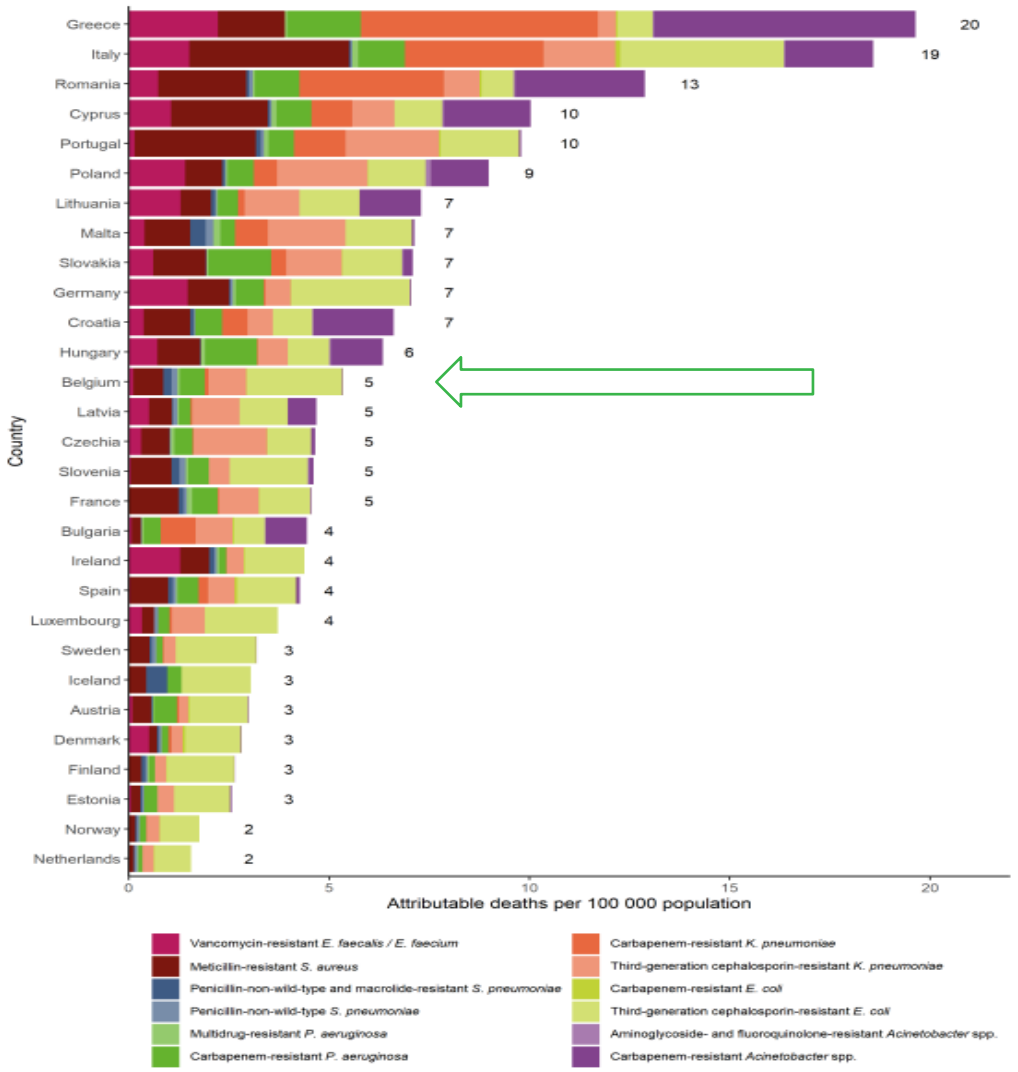
Attributable deaths in Europe, due to AMR

Figure 5. Estimations of the burden of infections with antibiotic-resistant bacteria presented as attributable deaths per 100 000 population by country*, EU/EEA, 2020



For Sweden, data reported to EARS-Net for 2016-2020 could not be checked for possible duplicate cases reported from the same patient.

https://www.ecdc.europa.eu/sites/default/files/documents/Health-burden-infections-antibiotic-resistant-bacteria.pdf

Attributable deaths AMR Belgium

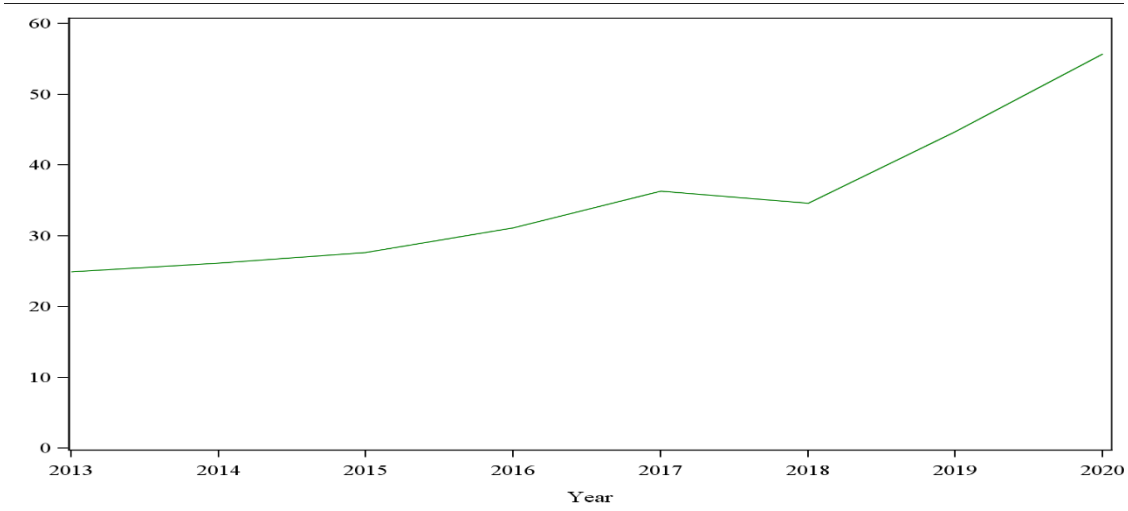
Belgium: Estimated number of attributable deaths due to infections with antibiotic-resistant bacteria, EU/EEA, 2016-2020 (by decreasing number of attributable deaths in 2020)

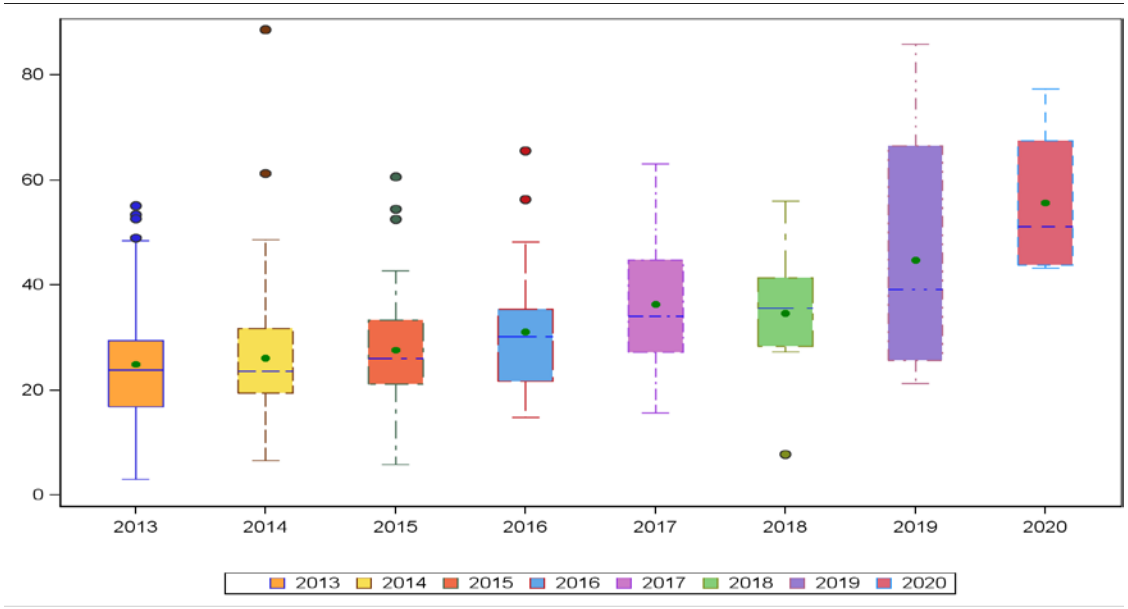
	2016	2017	2018	2019	2020
Third-generation cephalosporin-resistant *E. coli*	316 (278 - 357)	351 (311 - 394)	323 (286 - 361)	347 (308 - 389)	274 (243 - 306)
Third-generation cephalosporin-resistant *K. pneumoniae*	110 (102 - 118)	114 (106 - 124)	146 (135 - 157)	123 (114 - 132)	109 (101 - 118)
Meticillin-resistant *S. aureus*	173 (156 - 192)	130 (117 - 144)	156 (141 - 172)	89 (80 - 98)	85 (77 - 94)
Carbapenem-resistant *P. aeruginosa*	53 (41 - 67)	56 (42 - 73)	49 (36 - 63)	81 (60 - 104)	72 (54 - 93)
Penicillin-non-wild-type and macrolide-resistant *S. pneumoniae*	1 (1 - 1)	0 (0 - 0)	0 (0 - 0)	31 (29 - 33)	25 (23 - 26)
Penicillin-non-wild-type *S. pneumoniae*	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	23 (21 - 24)	16 (15 - 18)
Vancomycin-resistant *E. faecalis / E. faecium*	6 (6 - 8)	35 (31 - 39)	14 (12 - 17)	10 (9 - 13)	13 (12 - 15)
Carbapenem-resistant *K. pneumoniae*	22 (18 - 25)	12 (9 - 15)	17 (14 - 20)	11 (8 - 14)	11 (8 - 14)
Multidrug-resistant *P. aeruginosa*	4 (2 - 7)	10 (7 - 14)	8 (4 - 14)	10 (7 - 14)	7 (5 - 10)
Carbapenem-resistant *Acinetobacter* spp.	2 (1 - 3)	9 (6 - 11)	5 (4 - 7)	0 (0 - 0)	2 (1 - 3)
Carbapenem-resistant *E. coli*	3 (2 - 4)	1 (1 - 2)	4 (3 - 5)	3 (2 - 4)	1 (1 - 2)
Aminoglycoside- and fluoroquinolone-resistant *Acinetobacter* spp.	0 (0 - 0)	1 (0 - 2)	2 (1 - 3)	0 (0 - 0)	1 (0 - 1)
Overall	690 (607 - 782)	719 (630 - 818)	724 (636 - 819)	728 (638 - 825)	616 (540 - 700)

https://www.ecdc.europa.eu/sites/default/files/documents/Annex_2_burden_estimates_country_sheets.pdf

Preliminary evolution alcohol consumption Belgian acute care hospitals

Year	Number of hospitals
2013	70
2014	50
2015	48
2016	34
2017	32
2018	10
2019	7
2020	4





sciensano

COVID-19 CLINICAL HOSPITAL SURVEILLANCE REPORT
March 2020 – January 2021

Hospital wide

Table 2: Complications among all hospitalized patients.[5]

Complications	0-19	20-49	50-79	80+	All patients
Acute coronary syndrome	1 (0.2 %)	5 (0.2 %)	91 (1.1 %)	106 (1.9 %)	203 (1.2 %)
Altered consciousness	1 (0.2 %)	11 (0.5 %)	353 (4.2 %)	492 (9 %)	857 (5.2 %)
Pulmonary embolism	1 (0.2 %)	35 (1.5 %)	254 (3 %)	96 (1.8 %)	386 (2.3 %)
Hepatic hypoxia	0 (0 %)	8 (0.4 %)	73 (0.9 %)	25 (0.5 %)	106 (0.6 %)
Acute kidney injury	1 (0.2 %)	49 (2.2 %)	904 (10.8 %)	813 (14.9 %)	1767 (10.7 %)
MOF	0 (0 %)	12 (0.5 %)	209 (2.5 %)	119 (2.2 %)	340 (2.1 %)
Sepsis	2 (0.5 %)	29 (1.3 %)	372 (4.4 %)	189 (3.5 %)	592 (3.6 %)
Shock	1 (0.2 %)	18 (0.8 %)	269 (3.2 %)	92 (1.7 %)	380 (2.3 %)
Stroke	0 (0 %)	1 (0 %)	69 (0.8 %)	45 (0.8 %)	115 (0.7 %)

Table 3: Severity indicators (all hospitalized patients).[6]

Severity	Number (%)
Pneumonia based on medical imaging (CT or Xray)	20025 (77.5 %)
Bacterial or fungal superinfection	5063 (18.4 %)
ARDS	3367 (12.2 %)
Transferred to ICU	3400 (12.0 %)

Table 4: Case fatality rate (CFR) per age group (all hospitalized patients).

	Number (%)
0-19	1 (0.2 %)
20-49	61 (1.5 %)
50-79	2201 (15.1 %)
80+	3308 (36.4 %)

Intensive care units

Table 7: Complications among all intensive care patients, stratified by use of invasive ventilation.[9]

Complications	Not invasively ventilated	Invasively ventilated
Acute coronary syndrome	23 (1.6 %)	36 (1.9 %)
Altered consciousness	47 (3.2 %)	110 (5.9 %)
Pulmonary embolism	34 (2.3 %)	48 (2.6 %)
Hepatic hypoxia	10 (0.7 %)	49 (2.7 %)
Acute kidney injury	131 (9 %)	352 (19 %)
MOF	13 (0.9 %)	168 (9.1 %)
Sepsis	46 (3.2 %)	245 (13.3 %)
Shock	14 (1 %)	220 (11.9 %)
Stroke	13 (0.9 %)	23 (1.2 %)

Table 8: Severity indicators (ICU patients).[10]

Severity	Number (%)
Bacterial or fungal superinfection	1426 (41.9 %)
ARDS	1744 (51.4 %)
Invasive ventilation	1849 (54.4 %)
ECMO	146 (4.3 %)

Table 9: Case fatality rate (CFR) per age group (ICU patients).

	Number (%)
0-19	1 (5.3 %)
20-49	39 (8.7 %)
50-79	931 (37.7 %)
80+	310 (66.7 %)

R. DE PAUW, B. SERRIEN, N. VAN GOETHEM, D. VAN BECKHOVEN, K. BLOT, January 2021