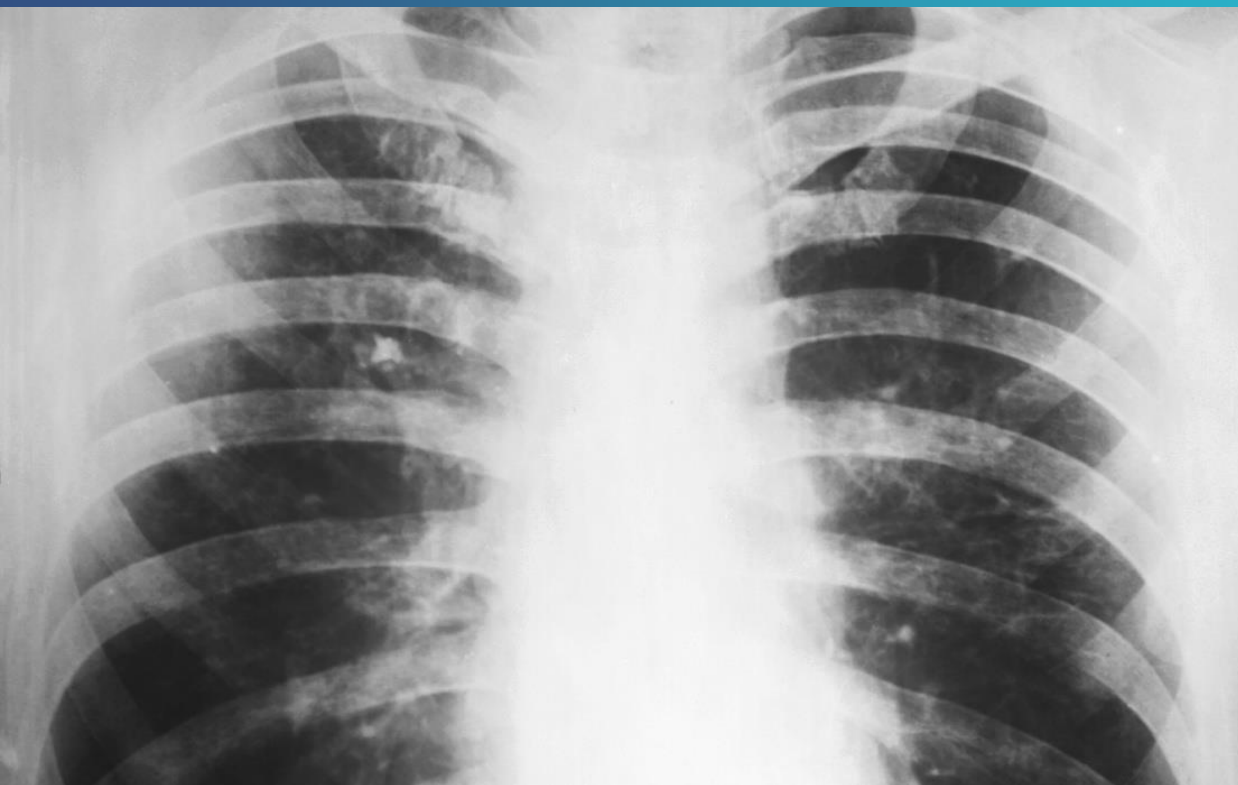




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# Critical Care Surveillance: Ventilator Associated Pneumonia

**Annual report:**

**All Wales**

2018

Version 1

Issued: 15/05/2019

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# Ventilator Associated Pneumonia (VAP)

## All Wales 2018 Summary



**10**  
hospitals  
submitted data



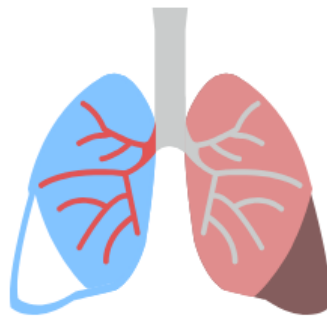
**64%**  
of patients  
with VAP  
were male

The median age  
of patients with  
VAP was

**60**  
years old

HELICS VAP rate

**1.86**  
VAPs per 1000  
ventilator days



Welsh VAP rate\*

**2.93**  
VAPs per 1000  
ventilator days

### VAP types



■ PNX (36.36%) ■ PN1 (39.39%) ■ PN2 (0%) ■ PN3 (0%)  
■ PN4 (19.70%) ■ PN5 (4.55%)

### Top 3 associated organisms



*Staphylococcus aureus* (16%)

*E. coli* (16%)

*Candida albicans* (10%)

All figures are based on HELICS VAPS unless otherwise stated.  
\*Welsh VAP rate includes an additional VAP type compared with HELICS (PNX)

## Data considerations

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Data is captured at unit level in Ward Watcher across Wales. Once a month data is extracted and emailed to Public Health Wales. The information found in this report may differ slightly from that found in the quarter 4 report issued 31/1/19. This may be due to additional data being received for the annual report subsequently. For this reason the annual report should be referenced when mentioning annual VAP data.

## Ventilator-Associated Pneumonia (VAP) definitions

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*The below details are a summary guide only, and should not be used to determine infection status. For a more detailed breakdown of the criteria, please see the HELICS definitions for ICU-acquired pneumonia.*

To be classified as a ventilator-associated pneumonia, an invasive respiratory device must have been present (even intermittently) in the 48 hours preceding the onset of infection; there must be two or more serial chest X-rays (CXR) or CT scans with a suggestive image of pneumonia (only one definitive CXR or CT scan is sufficient if there is no underlying cardiac or pulmonary disease). Additionally, there will be a combination of symptoms which include fever, leucopenia, leucocytosis, purulent sputum (or a change in sputum), cough, dyspnoea, tachypnoea, suggestive auscultation, ronchi, wheezing, and/or worsening gas exchange.

In addition to the clinical criteria, the following criteria determine which category the infection falls under:

- PN1 – Protected sample + quantitative culture ( $10^4$  CFU/ml BAL/ $10^3$  PB, DPA).
- PN2 – Non-protected sample (ETA) + quantitative culture ( $10^6$  CFU/ml).
- PN3 – Alternative microbiological criteria.
- PN4 – Sputum bacteriology or non-quantitative ETA.
- PN5 – No microbiological criterion met (only clinical criteria).
- PNX – Meets all requirements for PN1-4, but no CXR or CT scans have been done. Does not meet ECDC HELICS definition (but will be included for a Welsh VAP rate).

## Compliance

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14 hospitals across Wales have critical care units, and data should be submitted via email on a monthly basis. During 2018, 10 hospitals submitted data giving a 71.4% compliance rate. This was slightly reduced from 2017 (83.9% across 12 hospitals). There was no data submitted for Hywel Dda health board for 2018, and there were no infections reported for Cwm Taf health board during 2018.

## VAP rates (HELICS definition)

The European Centre for Disease Prevention and Control (ECDC) classifies VAPs according to the HELICS criteria.<sup>1</sup> This section of the report details VAPs according to the HELICS criteria (PN1-PN5).

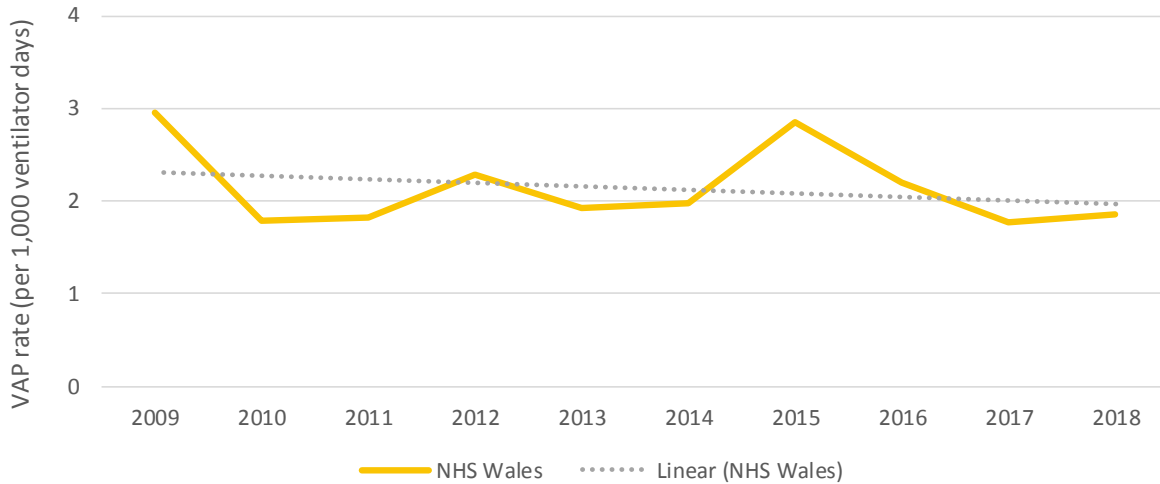


Figure 1: All Wales HELICS VAP trend rate (2009-2018)

	Ventilator days	VAP*	VAP rate (per 1,000 ventilator days)
<b>2009-2018</b>	192,016	403	<b>2.10</b>
<b>Year</b>			
2018	22,530	42	1.86
2017	24,209	43	1.78
2016	23,625	52	2.20
2015	10,496	30	2.86
2014	12,648	25	1.98
2013	22,264	43	1.93
2012	21,849	50	2.29
2011	18,705	34	1.82
2010	18,380	33	1.80
2009	17,310	51	2.95

There were 42 infections across Wales and 22,530 ventilator days in 2018, giving a VAP rate of 1.86 per 1,000 ventilator days. This number is likely to be higher, as some hospitals did not submit any data. The rate noted for 2018 is similar to 2017.

Of the 42 infections, 64.3% were attributed to males with a median age of 60 (range of 18-81).

\*Excluding infections recorded as PNX (PNO) on WardWatcher.

	4.20
	3.15
2009-2018 Welsh average	2.10
	1.05
	0.00

## VAP types (HELICS definition)

Figure 2 (below) shows a breakdown of VAPs by type (PN1-PN5).

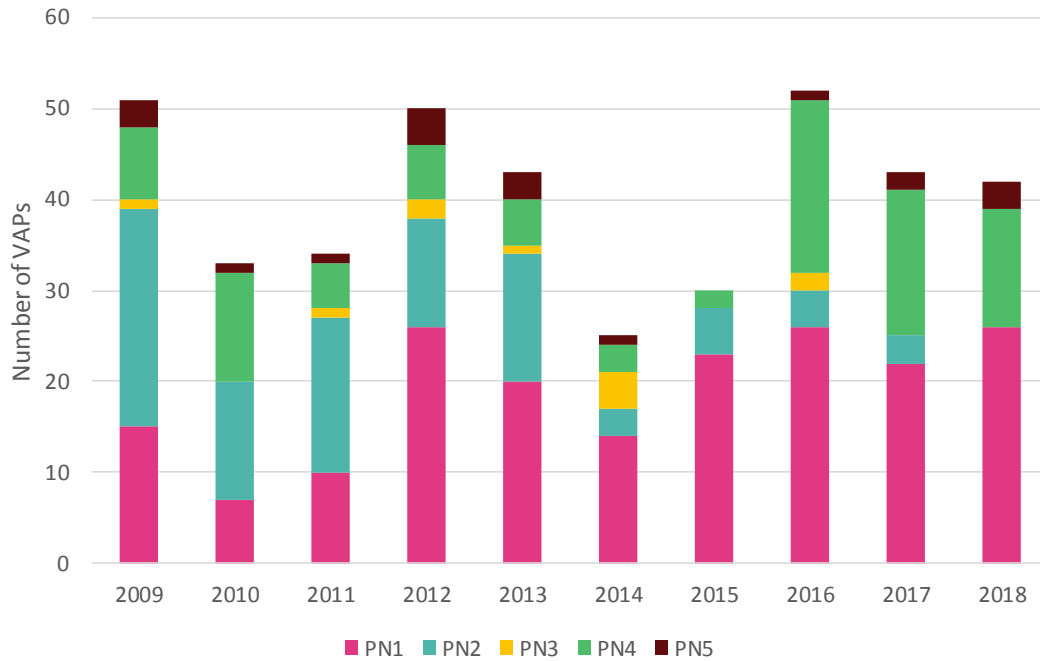


Figure 2: Number of VAPs determined by VAP type for Wales (2009-2018)

Across time, PN1 is the most common VAP type followed by PN4 and PN2. For 2018, PN1 was the most common VAP type followed by PN4. The number of VAPs was lower in 2014/15 due to a change of reporting methodology which led to decreased compliance.

## Causative organisms (HELICS VAPs)

Infections categorised as PN1, PN2, PN3, or PN4 have microbiology data provided. Up to 3 organisms can be captured per infection.

In 2018 54% (n=21) of HELICS infections reported had only one organism recorded and thus we are able to identify the causative organism.

The table below shows the number of causative organisms for 2018 as recorded in Ward Watcher. The level of detail varies by hospital, with some reporting resistance data and others not. The most common causative organisms in 2018 were *Escherichia coli* (19%), MRSA (14%), and *Enterobacter sp.* (other) (14%).

Table 1: Causative organisms 2018 (HELICS VAPS only)

Organism	Number of infections	Proportion of total
<i>Escherichia coli</i>	4	19.0
<i>Enterobacter sp.</i> (Other)	3	14.3
MRSA	3	14.3
<i>Pseudomonas aeruginosa</i>	2	9.5
<i>Staphylococcus aureus</i>	2	9.5
<i>Candida albicans</i>	1	4.8
<i>Enterobacter sp.</i> (Not specified)	1	4.8
<i>Klebsiella sp.</i> (Not specified)	1	4.8
<i>Proteus mirabilis</i>	1	4.8
<i>Pseudomonadaceae</i> family (Other)	1	4.8
<i>Serratia marcescens</i>	1	4.8
<i>Staphylococcus epidermidis</i>	1	4.8
<b>Grand Total</b>	<b>21</b>	<b>100</b>

## Associated organisms (HELICS VAPs)

The below table shows all associated organisms for VAPs meeting the HELICS definitions in 2018. The most common associated organisms in 2018 were *Staphylococcus aureus* (16%), *Escherichia coli* (16%), and *Candida albicans*, (10%).

Table 2: Associated organisms 2018 (HELICS VAPs only)

Organism	Number of infections	Proportion of total
<i>Escherichia coli</i>	10	16.4
<i>Staphylococcus aureus</i>	10	16.4
<i>Candida albicans</i>	6	9.8
<i>Pseudomonas aeruginosa</i>	4	6.6
<i>Klebsiella sp.</i> (Not specified)	4	6.6
<i>Enterobacter sp.</i> (Other)	4	6.6
MRSA	4	6.6
<i>Haemophilus influenzae</i>	3	4.9
<i>Staphylococcus epidermidis</i>	2	3.3
<i>Streptococcus sp.</i> (Other)	2	3.3
<i>Enterobacter sp.</i> (Not specified)	1	1.6
<i>Pseudomonadaceae</i> family (Not specified)	1	1.6
<i>Proteus mirabilis</i>	1	1.6
<i>Pseudomonadaceae</i> family (Other)	1	1.6
<i>Serratia marcescens</i>	1	1.6
<i>Enterococcus sp.</i> (Not specified)	1	1.6
<i>Candida sp.</i> (Not specified)	1	1.6
<i>Corynebacterium sp.</i>	1	1.6
MSSA	1	1.6
Gram negative bacilli other	1	1.6
Other coagulase negative staphylococci (CNS)	1	1.6
<i>Klebsiella sp.</i> (Other)	1	1.6
<b>Grand Total</b>	<b>61</b>	<b>100</b>



## Welsh VAP rates (including PNX)

In 2016 a new PN code was added to capture infections meeting all requirements for PN1-4, but where no CXR or CT scans have been done. This was following reported incidence of VAPs in Wales being lower than other European regions and a study which was conducted by Public Health Wales.<sup>2</sup>

This section details all VAPs recorded including PNX and compares the rates with and without the additional code.

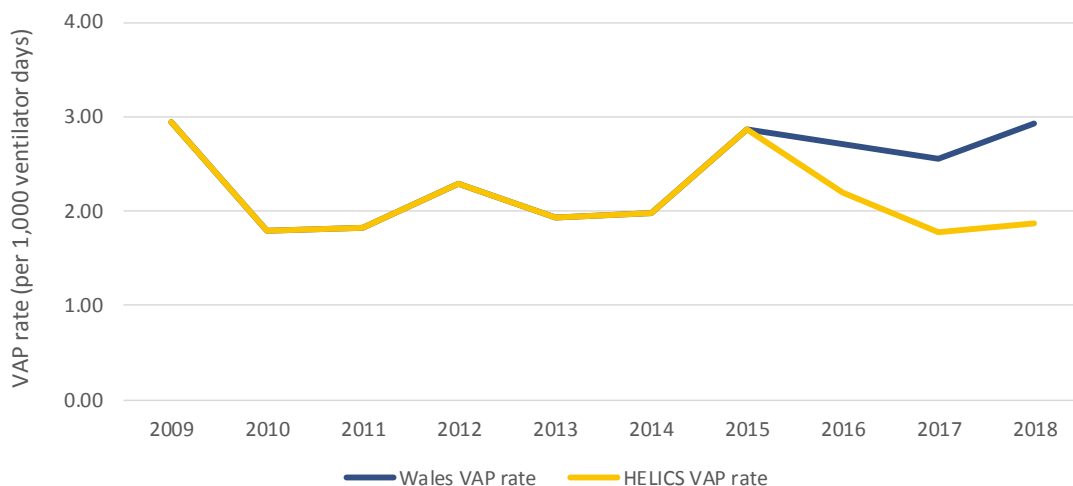


Figure 3: All Wales VAP trend rate over time compared with the HELICS VAP rate (2009-2018)

	Ventilator days	VAP*	VAP rate (per 1,000 ventilator days)	VAP**	VAP rate (per 1,000 ventilator days)
<b>2009-2018</b>	192,016	458	2.39	403	2.10
<b>Year</b>					
<b>2018</b>	22,530	66	2.93	42	1.86
<b>2017</b>	24,209	62	2.56	43	1.78
<b>2016</b>	23,625	64	2.71	52	2.20
<b>2015</b>	10,496	30	2.86	30	2.86
<b>2014</b>	12,648	25	1.98	25	1.98
<b>2013</b>	22,264	43	1.93	43	1.93
<b>2012</b>	21,849	50	2.29	50	2.29
<b>2011</b>	18,705	34	1.82	34	1.82
<b>2010</b>	18,380	33	1.80	33	1.80
<b>2009</b>	17,310	51	2.95	51	2.95

For 2018 there were 24 additional VAPs recorded when the PNX type was included, giving a total of 66 VAPs across Wales (42 HELICS). This gives a VAP rate per 1,000 ventilator days of 2.93. The Welsh VAP rate in 2018 was higher than in 2017 (2.56 per 1000 ventilator days). 62.1% of infections were attributed to males, with the median age being 59 and the age range being 18-83.

Since the introduction of the PNX code, the number of VAPs in Wales has increased, whereas the number of HELICS VAPs has decreased.

\*Including infections recorded as PNX (PNO) on WardWatcher.  
 \*\*Excluding infections recorded as PNX (PNO) on WardWatcher.

	4.77	4.20
	3.58	3.15
2009-2018 Welsh average	2.39	2.10
	1.19	1.05
	0.00	0.00

## VAP types (including PNx)

The following figure shows the number of VAPs broken down the by type of VAP recorded by the surveillance. The VAP types include those as noted by HELICS (PN1-PN5), and includes the Welsh PNx type from 2016 onwards.

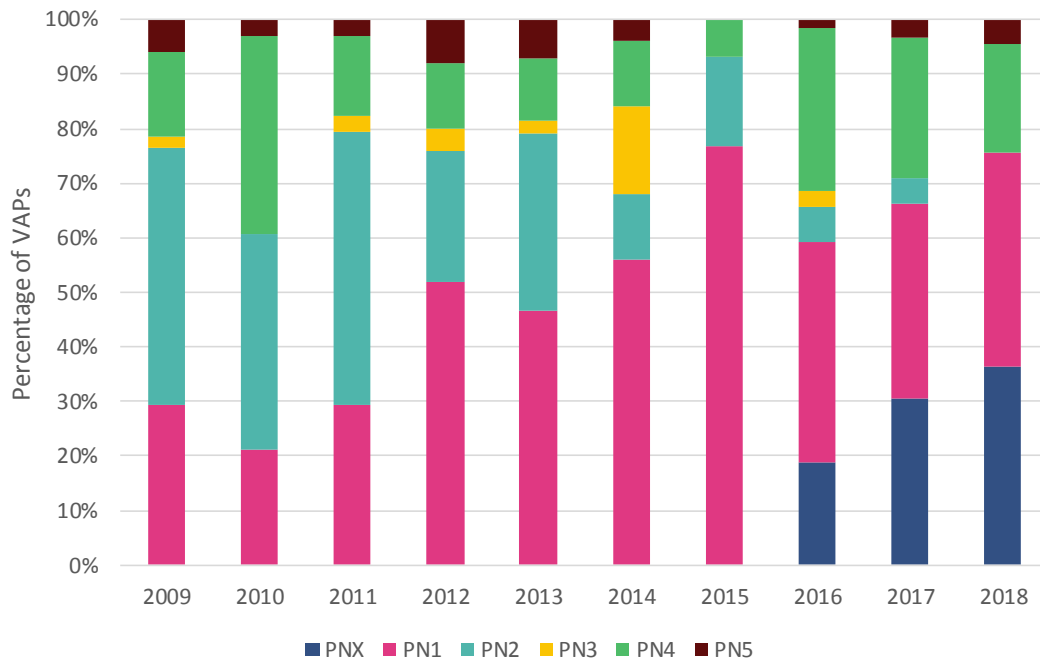


Figure 4: Proportion of VAPs by type for Wales (2009-2018)

Since the introduction of the PNx VAP type, the proportion of VAPs categorised as PNx has increased each year, (19% 2016, 31% 2017 and 36% in 2018). Compared to the HELICS VAPs, this illustrates an additional 12 VAPs in 2016, 19 VAPs in 2017, and 24 VAPs in 2018.

## Causative organisms

In 2018 56% of total infections (all VAP types) had just one organism reported and thus we are able to identify the causative agent.

Of the infections recorded as PNx, the most common causative organisms were *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. This is the same for HELICS VAPs, with the exception of *Enterobacter sp.* which were more common in HELICS VAPs than PNx VAPs.

Table 3: Causative organisms (PNx only compared to HELICS VAPs) 2018

Organism	VAP Type			Proportion of all VAP types
	PNx only	HELICS VAPs	All VAP types	
<i>Escherichia coli</i>	3	4	7	20.0
MRSA	1	3	4	11.4
<i>Staphylococcus aureus</i>	2	2	4	11.4
<i>Pseudomonas aeruginosa</i>	2	2	4	11.4
<i>Enterobacter sp.</i> (Other)	0	3	3	8.6
<i>Candida albicans</i>	1	1	2	5.7
<i>Staphylococcus epidermidis</i>	0	1	1	2.9
<i>Candida sp.</i> (Not specified)	1	0	1	2.9
<i>Klebsiella sp.</i> (Not specified)	0	1	1	2.9
<i>Klebsiella sp.</i> (Other)	1	0	1	2.9
<i>Enterobacter cloacae</i>	1	0	1	2.9
<i>Enterobacter sp.</i> (Not specified)	0	1	1	2.9
<i>Haemophilus influenzae</i>	1	0	1	2.9
<i>Proteus mirabilis</i>	0	1	1	2.9
<i>Pseudomonadaceae</i> family	0	1	1	2.9
<i>Serratia marcescens</i>	0	1	1	2.9
<i>Stenotrophomonas maltophilia</i>	1	0	1	2.9
<b>Grand Total</b>	<b>14</b>	<b>21</b>	<b>35</b>	<b>100.0</b>

## Associated organisms

The most common organisms associated with HELICS VAPs are also the most common organisms associated with PNx's, namely *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. In total across Wales, the most common associated organism for all VAP types was *Staphylococcus aureus* (16%), *Escherichia coli* (14%) and *Candida albicans* (10%).

Table 4: Associated organisms PNx compared with HELICS - 2018

Organism	VAP Type			Proportion of all VAP types
	PNx only	HELICS	All	
<i>Staphylococcus aureus</i>	5	10	15	15.5
<i>Escherichia coli</i>	4	10	14	14.4
<i>Candida albicans</i>	4	6	10	10.3
MRSA	3	4	7	7.2
<i>Pseudomonas aeruginosa</i>	2	4	6	6.2
<i>Haemophilus influenzae</i>	3	3	6	6.2
<i>Candida sp.</i> (Not specified)	3	1	4	4.1
<i>Klebsiella sp.</i> (Not specified)	0	4	4	4.1
<i>Enterobacter sp.</i> (Other)	0	4	4	4.1
<i>Streptococcus sp.</i> (Other)	2	2	4	4.1
<i>Klebsiella sp.</i> (Other)	2	1	3	3.1
<i>Corynebacterium sp.</i>	2	1	3	3.1
<i>Staphylococcus epidermidis</i>	0	2	2	2.1
Gram negative bacilli other	1	1	2	2.1
<i>Stenotrophomonas maltophilia</i>	2	0	2	2.1
MSSA	0	1	1	1.0
<i>Candida glabrata</i>	1	0	1	1.0
<i>Pseudomonadaceae</i> family (Not specified)	0	1	1	1.0
<i>Pseudomonadaceae</i> family (Other)	0	1	1	1.0
<i>Enterobacter cloacae</i>	1	0	1	1.0
<i>Enterobacter sp.</i> (Not specified)	0	1	1	1.0
<i>Enterococcus sp.</i> (Not specified)	0	1	1	1.0
Other coagulase negative staphylococci (CNS)	0	1	1	1.0
<i>Proteus mirabilis</i>	0	1	1	1.0
<i>Serratia marcescens</i>	0	1	1	1.0
<i>Streptococcus pneumoniae</i>	1	0	1	1.0
<b>Grand Total</b>	<b>36</b>	<b>61</b>	<b>97</b>	<b>100.0</b>

## References

- 1) <https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/healthcare-associated-infections-HAI-ICU-protocol.pdf>
- 2) <https://www.frontiersin.org/articles/10.3389/fmicb.2016.01271/full>