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CRITICAL CARE ANNUAL REPORT

CENTRAL VENOUS CATHETER AND VENTILATOR ASSOCIATED PNEUMONIA

2009

ALL WALES

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Issued Date: 07 January 2011

Version: 1

This report provides infection rates for all Wales, allowing comparisons to be made with critical care schemes in other countries. Care should be taken when interpreting such results due to the possible differences in methodology utilised. However, in Wales it is important to ensure that inter-unit comparisons are made over time utilising both bi-monthly and annual reports provided. This will ensure that the units can monitor their own performance over time.

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INTRODUCTION

The Welsh Healthcare Associated Infection Programme (WHAIP) was established in 1996. The aims of the programme are to develop an evidential base for control of healthcare associated infections in Wales, identify preventable aspects and audit compliance with agreed practices.

In September 2004, the Welsh Assembly Government launched 'Healthcare Associated Infections – A strategy for hospitals in Wales'. One of the strategic objectives within this strategy was for Health Boards to adopt comprehensive surveillance programmes including infections in critical care (Part 2 – framework tables, page 14)¹. Consequently, WAG instructed the WHAIP to develop and support the implementation of critical care infection surveillance in NHS hospitals in Wales. During 2005 – 2006, the National Leadership and Innovation Agency for Healthcare (NLIAH), through the Welsh Critical Care Improvement Programme (WCCIP), launched care bundles for the insertion and maintenance of central venous catheters on critical care and also care bundles to prevent ventilator associated pneumonia.

The surveillance of central venous catheter (CVC) related infections became mandatory in Wales on the 1st September 2007. The WHAIP team collaborated with the NLIAH group to develop critical care surveillance in Wales utilising HELICS defined infection criteria². The surveillance will serve to provide useful infection data for critical care clinicians and infection control practitioners as well as serving as an outcome measure for the care bundles. Before being made mandatory, surveillance of CVC infections associated with critical care units was undertaken voluntarily by all hospitals in Wales. In September 2008 critical care surveillance was extended to include the mandatory surveillance of ventilator associated pneumonia (VAP) infections. The latter part of 2008 was utilised to try and embed VAP surveillance in hospitals in Wales.

Patients admitted to critical care are at 5 to 10 times higher risk of acquiring a nosocomial infection due to both intrinsic and extrinsic risk factors, and because the critical care unit is often the epicentre of emerging nosocomial infection problems in the hospital². CVC bloodstream infections and VAPs are the most common nosocomial infections in critical care, where they can prolong the critical care stay, be associated with substantial mortality and related costs (both financial and in quality of care)³. The mortality from VAP can range from 24 – 50%⁴. However, it is well known that many infections (both CVC and VAP) are preventable⁵. It has been suggested that by combining a number of evidence based interventions in a 'care bundle' and administering these interventions to every critical care patient (every day of their stay), these risks to the patient may be significantly lowered. Promotion of care bundles have been made by the Institute for Health Improvement and Centre for Disease Control in the USA and by the Modernisation Agency and Department of Health in the UK³.

This is the first national report that combines both CVC and VAP infections associated with critical care units in Wales. The data presented here is a summary of information provided by the six Health boards for 2009 (1st January 2009 – 31st December 2009). CVC infection results provided in this 2009 report can be compared with the 2008 report, however this is the first report produced for VAP data. The report includes data captured using strict HELICS defined criteria and thus includes infections associated with critical care units only. The surveillance incorporates data collected by intensivists and their teams using the internationally agreed definitions, allowing Welsh data to be compared with and be incorporated into other international databases, such as the HELICS European SSI database / ECDC². The purpose of the surveillance in the early years of data collection is to provide an initial baseline infection rate to assist Health boards in monitoring both their system of data collection and to aid with reducing infection over time.

CENTRAL VENOUS CATHETER

SUMMARY – Central Venous Catheter (CVC) Surveillance

- This is the second annual report covering the mandatory central venous catheter (CVC) infection surveillance in critical care in Wales (2009). The report covers CVC related infections associated with critical care as defined utilising HELICS criteria.
- A total of 4875 forms were received for the period 01/01/2009 – 31/12/2009. 4820 (99%) of forms could be further analysed for determining the CVC infection rate.
- All data items on the CVC forms were excellently completed. The line removal dates were on occasion missing. This was due to the patient being discharged from critical care with a line still in place.
- To date, we do not yet have data on compliance of the Health Boards with the surveillance and we will be carrying out validation of the data across Wales in 2011. The results provided for all Wales should therefore be treated with caution until such information is gathered and made available.
- A total of 29 infections were recorded by the surveillance with 62% (18 infections) meeting HELICS infection criteria. An overall infection rate of 0.7 per 1000 catheter days was noted for the period 01/01/2009 – 31/12/2009. The mean all Wales rate was also 0.7 per 1000 catheter days with a median of 0.6 per 1000 catheter days (Health Board rates varied from 0.0 – 1.6 per 1000 catheter days).
- The overall infection rate broken down by infection type was 0.26, 0.26 and 0.15 per 1000 catheter days for CRI 1, CRI 2 and CRI 3 infections, respectively. The majority of infections noted were categorised as local infections (CRI 1) or general infections (CRI 2).
- The overall monthly CVC infection rate for all Wales varied from 0.0 to 1.8 per 1000 catheter days for the 12 month period.
- Approximately 60% of CVC lines were inserted on critical care and approximately 33% in theatre. The majority of line infections were associated with lines inserted on critical care. Of the 18 HELICS infections, 12 were attributed to critical care, 5 to theatre, 1 to an unspecified insertion location.
- 76% of lines were inserted in the jugular vein, 13% in the femoral vein and 10% in the subclavian vein. The majority of CVC infections were associated with the jugular vein (11), whilst 4 and 3 infections were noted with the femoral and subclavian, respectively. It should be noted that line insertion site practice does differ between Health Boards in Wales.
- Coagulase negative *Staphylococci* were associated with the highest number of HELICS defined CVC infections in Wales. A total of 8 infections were noted with 6 attributed to lines inserted on critical care. 4 infections were identified as *Candida sp.* Other organisms identified included *Enterococcus sp.*, MRSA (Flucloxacillin resistant), *Enterobacter sp.* and *Klebsiella sp.*

ALL WALES RESULTS - Central Venous Catheter (CVC) Surveillance

The time period for this report is based on the date of intubation. Therefore only records with the date of intubation completed have been included for analysis. Patients that have not been on Critical Care for over 48 hours have also been excluded.

SECTION 1: Form Feedback

Form Returns

Table 1.1 Form returns for All Wales for patients with lines inserted for the period 01/01/2009 - 31/12/2009

Number of forms received for critical care patients with lines inserted	Number of valid forms*	Percentage of valid forms
4875	4820	98.9%

* Valid forms include forms where insertion date, admission to critical care date and (removal or discharge) date are completed

Completion Rates

Table 1.2 Percentage completion of data items on the CVC surveillance forms for All Wales for the period 01/01/2009 - 31/12/2009

Question	Number completed	Number expected	Completion rate %
Age	4828	4875	99.0%
Sex	4855	4875	99.6%
Date of admission to hospital	4813	4875	98.7%
Date of admission to critical care	4854	4875	99.6%
Site of CVC insertion	4825	4875	99.0%
Hospital location of CVC insertion	4733	4875	97.1%
CVC removal date	4259	4875	87.4%
Date of discharge from critical care*	2270	2270	100.0%

* Excludes records where the patient has not yet been discharged from critical care

Key Summary Points

- 4875 forms were received for the period 01/01/09 – 31/12/09 with 99% valid for data analysis.
- All data items on the form were excellently completed.
- The completion rate for the CVC removal data was lower than for all other fields as some of the patients still had their line in situ on discharge from critical care thus preventing this date from being completed.

SECTION 2: HELICS defined CVC infection rate

Overall HELICS CVC infection rate

Table 2.1 Overall HELICS defined CVC infection rate for All Wales for the period 01/01/2009 - 31/12/2009

Total number of infections recorded*: 29

Number and percentage of infections that meet the HELICS criteria: 18 (62%)

Number of HELICS CVC infections	Number of critical care catheter days**	HELICS CVC infection rate*** (per 1000 critical care catheter days)
18	27014	0.7

* Where microbiological and clinical signs provided enable an infection to be deemed either as HELICS CVC infection or as a locally defined CVC associated infection

** Only catheter days up to discharge of patient from critical care are included. Number of critical care catheter days calculated = removal date - insertion date + 1 (unless the insertion date precedes the admission to critical care date i.e. insertion date is replaced by admission to critical care date, or if the removal date succeeds discharge date from critical care then removal date is replaced by discharge date)

*** Calculation of HELICS CVC infection rate = total number of HELICS CVC infections / number of critical care catheter days * 1000

The mean all Wales rate was also 0.7 per 1000 catheter days with a median of 0.6 per 1000 catheter days (Health Board rates varied from 0.0 – 1.6 per 1000 catheter days).

Incidence of HELICS CVC infections by infection type

Table 2.2 Breakdown of HELICS defined CVC infection rate by infection type for All Wales for the period 01/01/2009 - 31/12/2009

Infection type	Number of HELICS CVC infections	HELICS CVC infection rate* (per 1000 critical care catheter days)
CRI 1	7	0.26
CRI 2	7	0.26
CRI 3	4	0.15

* Calculation of HELICS CVC infection rate = total number of HELICS CVC infections / number of critical care catheter days * 1000

Incidence of HELICS CVC infections by month

Figure 2.1 HELICS defined CVC infection rate by month for All Wales for the period 01/01/2009 - 31/12/2009

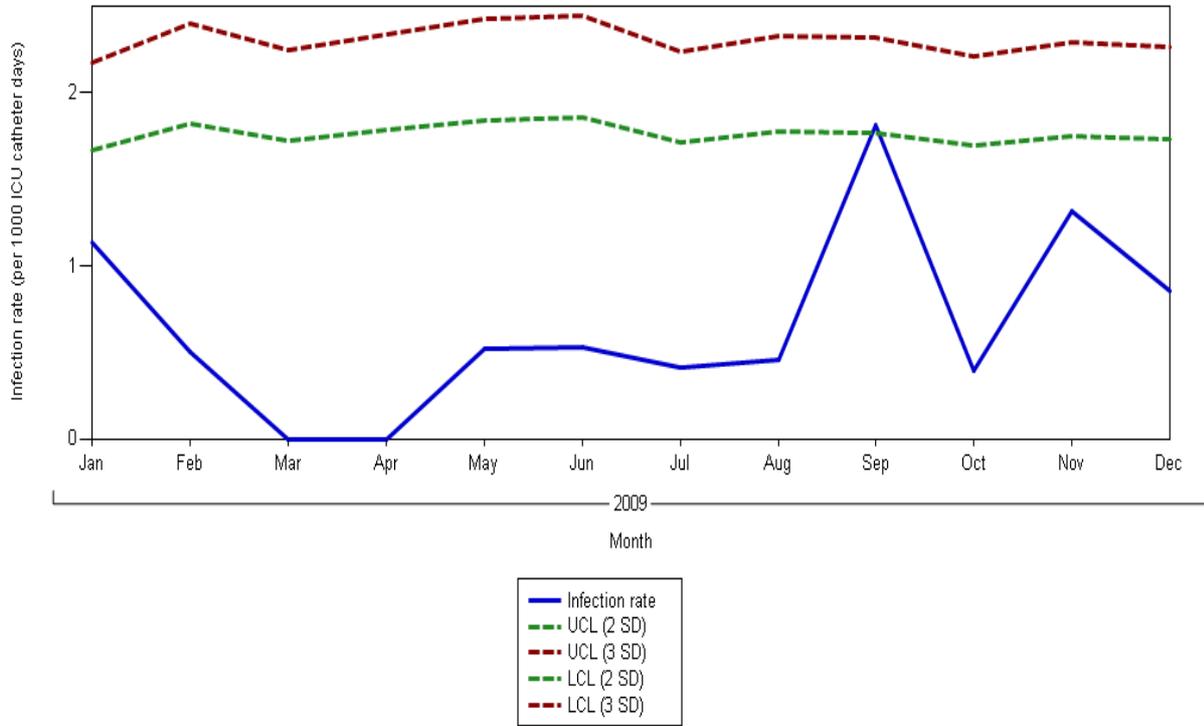
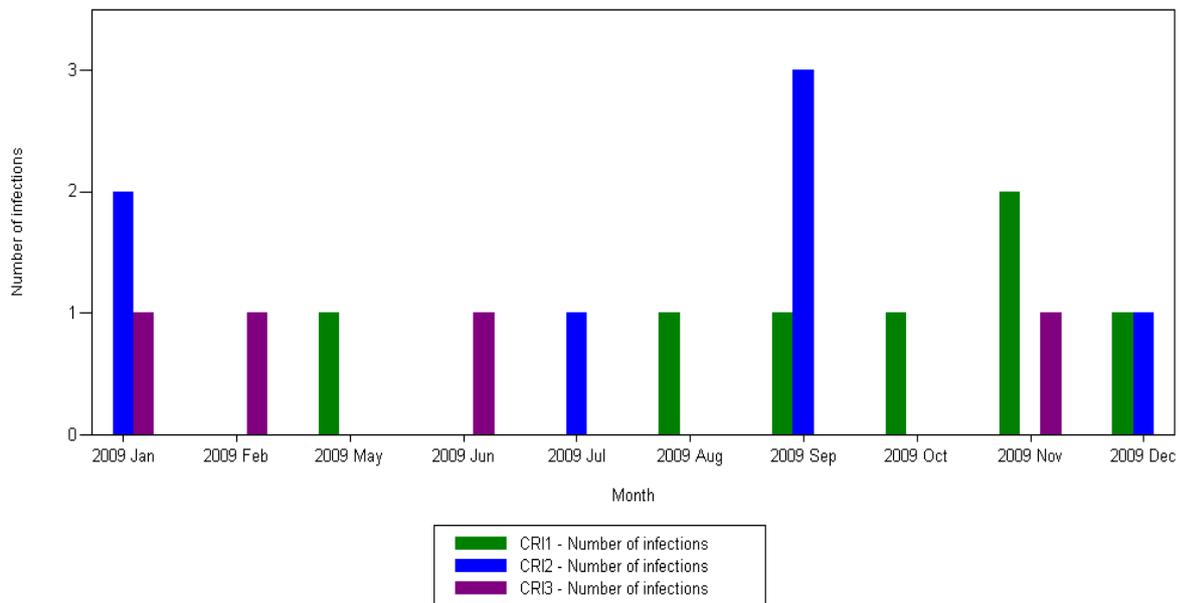


Figure 2.2 Numbers of HELICS defined CVC infections by month and infection type for All Wales for the period 01/01/2009 – 31/12/2009

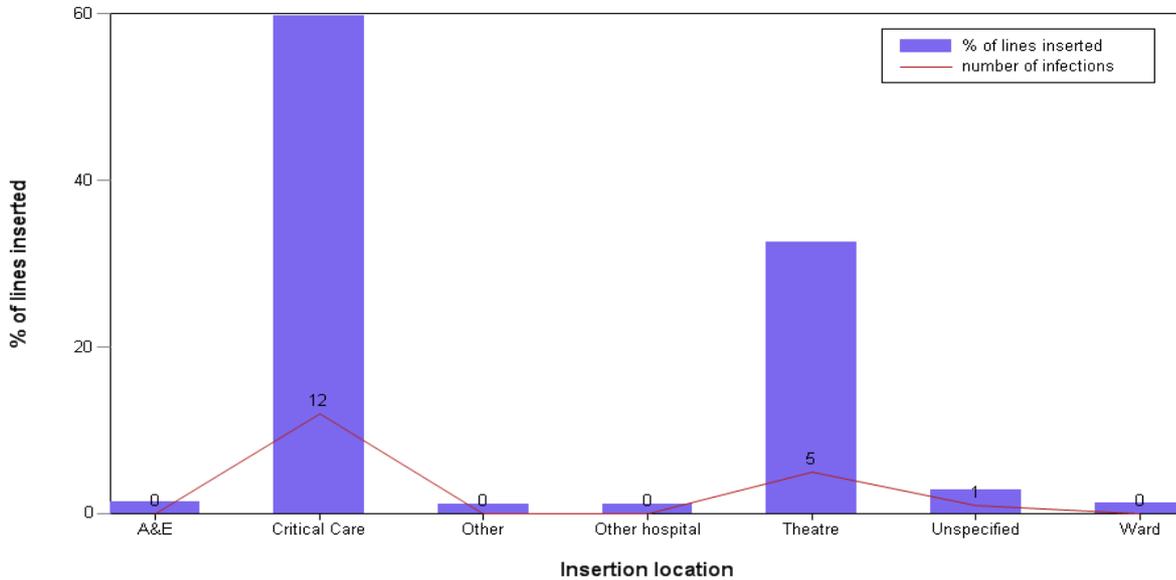


Key Summary Points

- The total number of infections recorded by the surveillance for the period 01/01/09 – 31/12/09 was 29 however, only 62% of these met with the HELICS defined infection criteria.
- A HELICS defined CVC infection rate of 0.7 per 1000 catheter days was noted for the period 01/01/09 – 31/12/09.
- The mean all Wales infection rates was also 0.7 per 1000 critical care catheter days with a median of 0.6 per 1000 catheter days.
- The overall monthly infection rate varied from 0.0 to 1.8 per 1000 critical care catheter days over the 12 month period. For most of this time period the infection rate remained 'in control' as most monthly rates were shown to be below the upper control limits (UCL) at 2 standard deviations (2 SD) and 3 standard deviations (3 SD) above the mean rate. The exception was September when the monthly rate went above 2 standard deviations (2 SD) above the mean rate.
- The majority of infections noted were categorised as either CRI 1 (local infections) or CRI 2 infections (general infections). There were 7 CRI 1 and 7 CRI 2 infections reported.
- Infection rates of 0.26, 0.26 and 0.15 were noted for CRI 1, CRI 2 and CRI 3 infections respectively.
- To date, we do not yet have data on compliance of the Health boards with the surveillance. The results provided for all Wales should therefore be treated with caution until such information is gathered and made available.
- The purpose of the all Wales rate provided in this report is to allow comparisons with rates across other countries.

SECTION 3. Incidence of HELICS CVC infection by hospital location of line insertion

Figure 3.1 Percentage of CVC insertions and numbers of HELICS defined CVC infections by insertion location for All Wales for the period 01/01/2009 – 31/12/2009

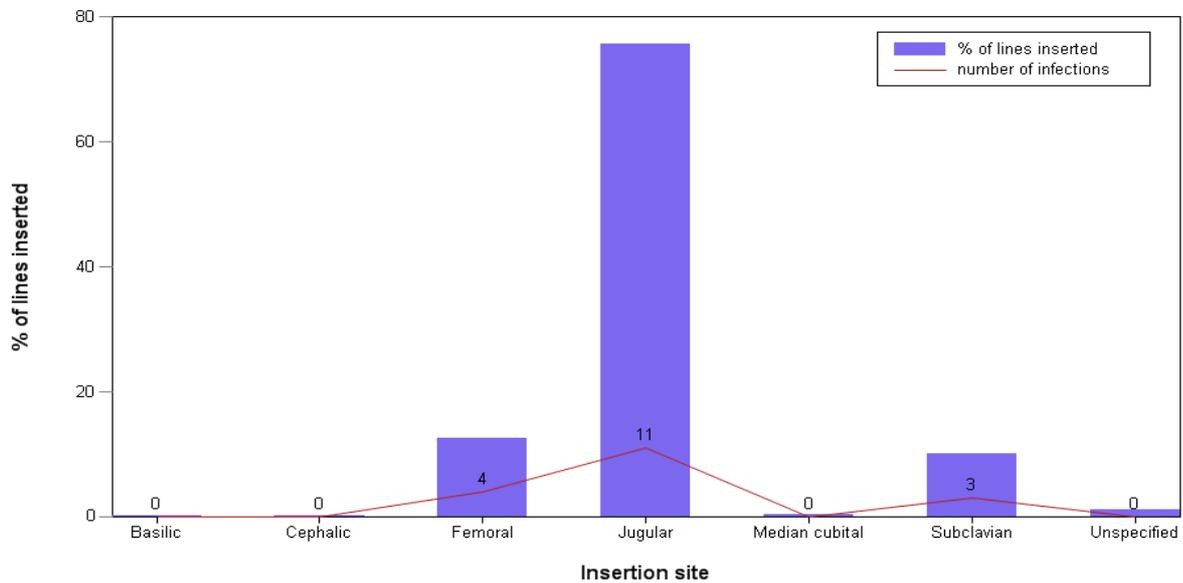


Key Summary Points

- The majority of lines were inserted on critical care (approximately 60%) and in theatre (approximately 33%).
- The majority of HELICS defined CVC infections noted were attributed to lines inserted on critical care (12).
- 5 infections were attributed to lines inserted in theatre and 1 to an unspecified insertion location.

SECTION 4. Incidence of HELICS CVC infection by line insertion site

Figure 4.1 Percentage of CVC insertions and numbers of HELICS defined CVC infections by insertion site for All Wales for the period 01/01/2009 – 31/12/2009

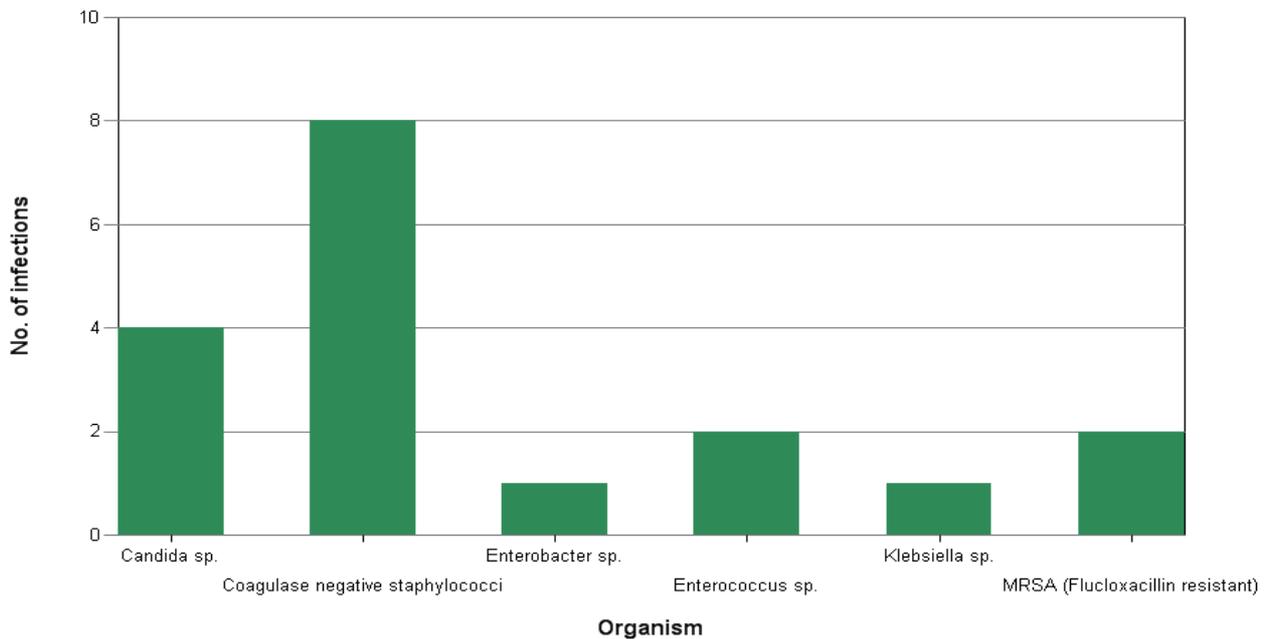


Key Summary Points

- The majority of lines were inserted in the jugular vein (76%) whilst 13% and 10% of lines were inserted into the femoral and subclavian veins, respectively.
- The majority of CVC infections were associated with lines inserted in the jugular vein (11).
- 4 infections were associated with lines inserted into the femoral vein and 3 infections with line insertions into the subclavian vein.

SECTION 5. Incidence of HELICS CVC infection by organism

Figure 5.1 Numbers of HELICS defined CVC infections by organism for All Wales for the period 01/01/2009 – 31/12/2009



Key Summary Points

- Coagulase negative *Staphylococci* were associated with the highest number of HELICS defined CVC infections. A total of 8 infections were noted with 6 of these attributed to lines inserted on critical care.
- 4 of the infections identified were noted as *Candida sp.*
- MRSA (Flucloxacillin resistant) and *Enterococcus sp.* accounted for 2 infections each.
- *Enterobacter sp.* and *Klebsiella sp.* accounted for 1 infection each.

VENTILATOR ASSOCIATED PNEUMONIA

SUMMARY - Ventilator Associated Pneumonia (VAP) Surveillance

- This is the first annual report covering the mandatory ventilator associated pneumonia (VAP) infection surveillance in critical care in Wales (2009). The report covers VAPs associated with critical care as defined utilising HELICS criteria.
- A total of 2033 forms were received for the period 01/01/2009 – 31/12/2009. 2008 (99%) of forms could be further analysed for determining the VAP rate.
- All data items on the VAP forms were excellently completed.
- To date, we do not yet have data on compliance of the Health Boards with the surveillance and we will be carrying out validation of the data across Wales in 2011. The results provided for all Wales should therefore be treated with caution until such information is gathered and made available.
- A total of 37 VAPs were recorded by the surveillance. An overall VAP rate of 2.2 per 1000 ventilator days was noted for the period 01/01/2009 – 31/12/2009. The mean all Wales rate was 2.4 per 1000 ventilator days with a median of 3.0 per 1000 ventilator days (Health Board rates varied from 0.0 – 4.0 per 1000 ventilator days).
- The overall VAP rate broken down by VAP type was 0.72, 1.38, 0.06 and 0.06 per 1000 ventilator days for PN1, PN2, PN3 and PN4, respectively. The majority of VAPs noted were categorised as PN2 or PN1.
- The overall monthly VAP rate for all Wales varied from 0.0 to 3.3 per 1000 ventilator days for the 12 month period.
- Approximately 50% of intubations were associated with medical cases and approximately 40% with surgical cases. The majority of VAPs were associated with medical cases. Of the 37 VAPs, 17 were associated with medical cases, 13 surgical, 5 trauma and 2 did not have the case type specified.
- Risk factors of either chronic obstructive pulmonary disease (COPD) or diabetes mellitus were noted for 454 of the cases reported for 2009 (212 and 242, respectively). 7 infections were associated with COPD as the risk factor and 5 with diabetes as the risk factor.
- *Pseudomonas sp.* was associated with the highest number of HELICS defined VAPs in Wales (total of 9 infections). 8 infections were identified as *Candida sp.* Other organisms identified included MRSA (Flucloxacillin resistant), *Escherichia coli*, other Gram negative organism, other yeast, Coagulase negative *staphylococci*, *Staphylococcus aureus* (Flucloxacillin sensitive), *Proteus sp.*, *Klebsiella sp.* and other Gram positive organism.

ALL WALES RESULTS - Ventilator Associated Pneumonia (VAP) Surveillance

The time period for this report is based on the date of intubation. Therefore only records with the date of intubation completed have been included for analysis. Patients that have not been on Critical Care for over 48 hours have also been excluded.

SECTION 1: Form Feedback

Form Returns

Table 1.1 Form returns for All Wales for patients ventilated for the period 01/01/2009 - 31/12/2009

Number of forms received for critical care ventilated patients	Number of valid forms*	Percentage of valid forms
2035	2017	99.1%

* Valid forms include forms where insertion date, admission to critical care date and (removal or discharge) date are completed

Completion Rates

Table 1.2 Percentage completion of data items on the VAP surveillance forms for All Wales for the period 01/01/2009 - 31/12/2009

Question	Number completed	Number expected	Completion rate %
Age	1969	2035	96.8%
Sex	2025	2035	99.5%
Date of admission to hospital	2012	2035	98.9%
Date of admission to critical care	2035	2035	100.0%
Risk factors	462	Not applicable	
Type of case	1964	2035	96.5%
Date of extubation	1892	2035	93.0%
Date of discharge from critical care*	1417	1417	100.0%

* Excludes records where the patient has not yet been discharged from critical care

Key Summary Points

- 2035 forms were received for the period 01/01/09 – 31/12/09 with 99% valid for data analysis.
- All data items on the form were excellently completed.

SECTION 2: HELICS defined VAP rate

Overall HELICS VAP rate

Table 2.1 Overall HELICS defined VAP rate for All Wales for the period 01/01/2009 - 31/12/2009

Number of HELICS VAP	Number of critical care ventilator days*	HELICS VAP rate** (per 1000 critical care ventilator days)
37	16636	2.2

* Only ventilator days up to discharge of patient from Critical Care are included. Number of Critical Care ventilator days calculated = extubation date - intubation date + 1 (unless the intubation date precedes the admission to critical care date i.e. intubation date is replaced by admission to critical care date, or if the extubation date succeeds discharge date from Critical Care then extubation date is replaced by discharge date)

** Calculation of HELICS VAP rate = total number of HELICS VAP / number of critical care ventilator days * 1000

The mean all Wales rate was 2.4 per 1000 ventilator days with a median of 3.0 per 1000 ventilator days (Health Board rates varied from 0.0 – 4.0 per 1000 ventilator days).

Incidence of HELICS VAP by infection type

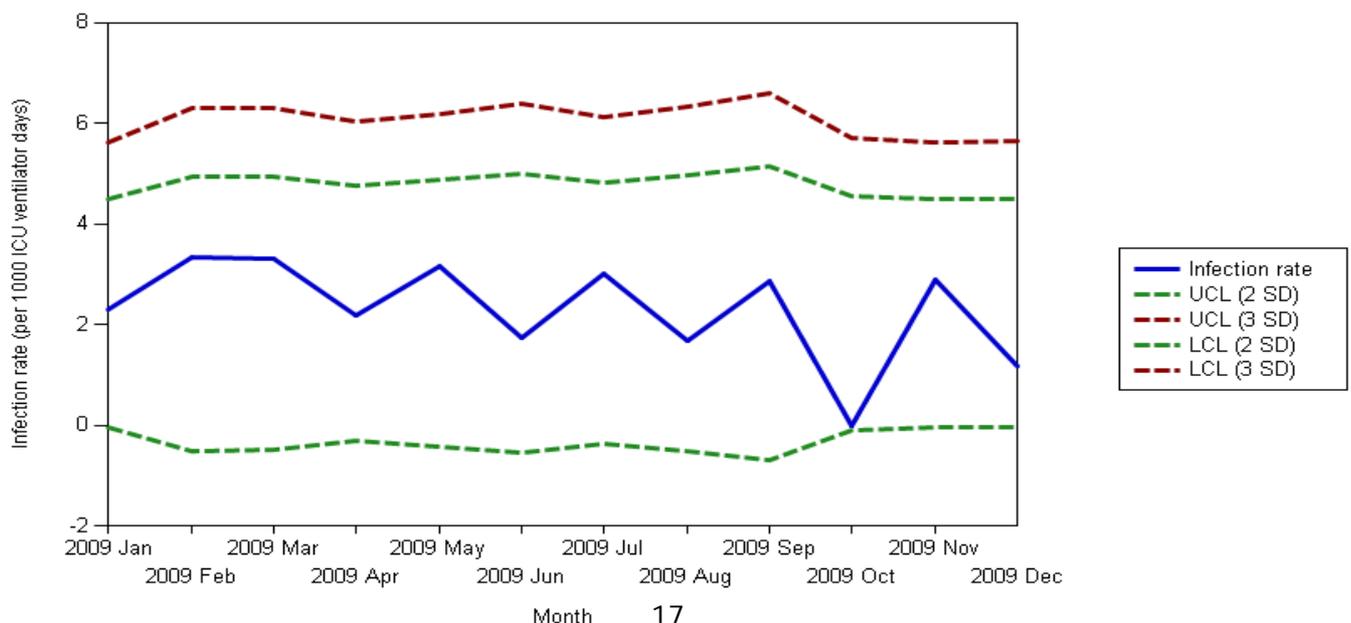
Table 2.2 Breakdown of HELICS defined VAP rate by infection type for All Wales for the period 01/01/2009 - 31/12/2009

VAP type	Number of HELICS VAP	HELICS VAP rate* (per 1000 critical care ventilator days)
PN1	12	0.72
PN2	23	1.38
PN3	1	0.06
PN4	1	0.06

* Calculation of HELICS VAP rate = total number of HELICS VAP / number of critical care ventilator days * 1000

Incidence of HELICS VAP by month

Figure 2.1 HELICS defined VAP rate by month for All Wales for the period 01/01/2009 - 31/12/2009

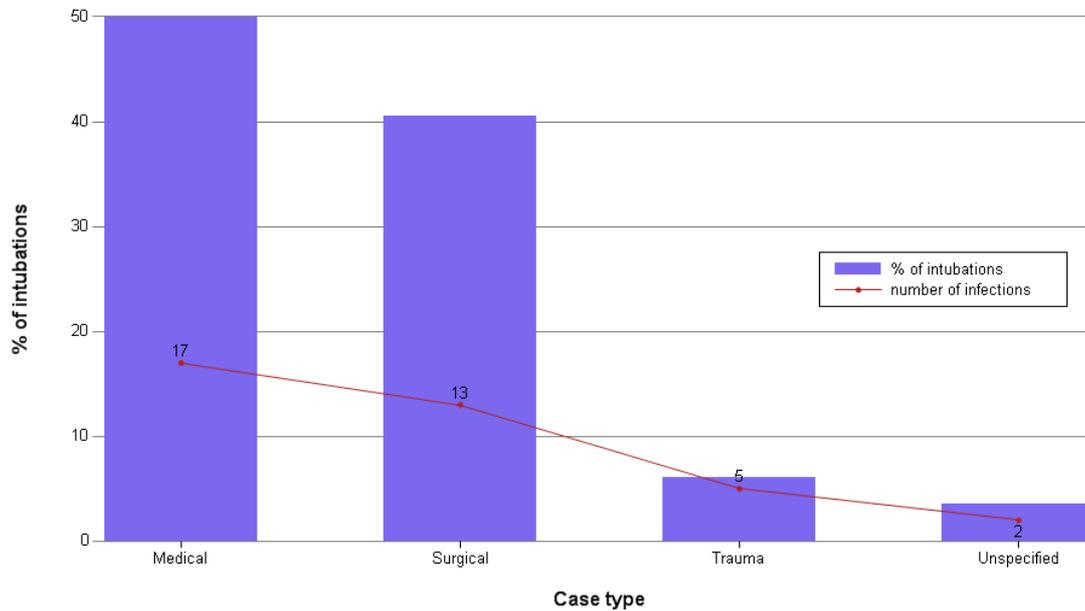


Key Summary Points

- Only HELICS defined VAPs are collected for the VAP surveillance.
- The total number of VAPs recorded by the surveillance for the period 01/01/09 – 31/12/09 was 37.
- A HELICS defined VAP rate of 2.2 per 1000 ventilator days was noted for the period 01/01/09 – 31/12/09.
- The mean all Wales infection rates was 2.4 per 1000 critical care ventilator days with a median of 3.0 per 1000 ventilator days.
- The overall monthly infection rate varied from 0.0 to 3.3 per 1000 critical care ventilator days over the 12 month period. During this time the VAP rate remained 'in control' as all rates were shown to be below the upper control limits (UCL) at 2 standard deviations (2 SD) and 3 standard deviations (3 SD) above the mean rate.
- The majority of VAPs noted were categorised as either PN2 (23) or PN1 (12).
- Infection rates of 0.72, 1.38, 0.06 and 0.06 were noted for PN1, PN2, PN3 and PN4, respectively.

SECTION 3. Incidence of HELICS VAP by case type

Figure 3.1 Percentage of intubations and HELICS defined VAP numbers by case type for All Wales for the period 01/01/2009 – 31/12/2009

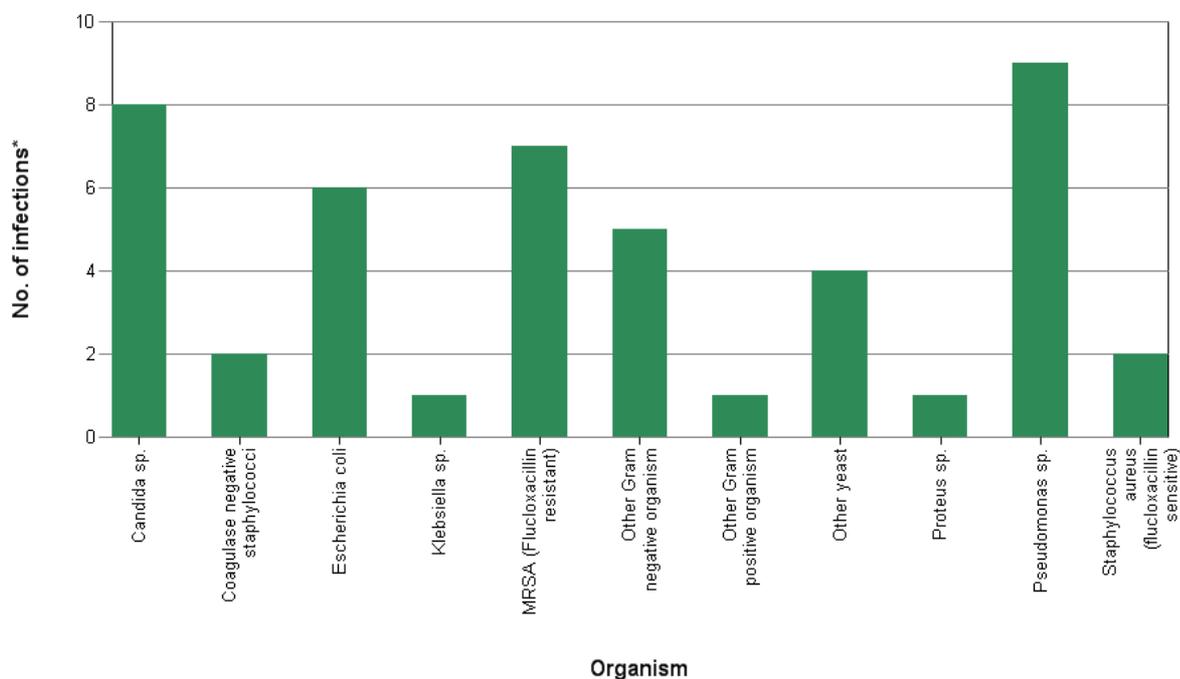


Key Summary Points

- Approximately 50% of intubations were associated with medical cases and approximately 40% with surgical cases.
- The majority of VAPs were associated with medical cases. Of the 37 VAPs, 17 were associated with medical cases, 13 surgical, 5 trauma and 2 did not have the case type specified.

SECTION 4. Incidence of HELICS VAP by organism

Figure 4.1 Numbers of HELICS defined VAP by organism for All Wales for the period 01/01/2009 – 31/12/2009



Key Summary Points

- A VAP infection may include more than 1 result organism. Microbiological diagnosis allows for up to 3 positive organisms to be noted. The number of infections may therefore not correspond to the number of organisms.
- *Pseudomonas sp.* were associated with the highest number of HELICS defined VAPs in Wales. A total of 9 VAPs were noted.
- *Candida sp.*, MRSA (Flucloxacillin resistant) and *Escherichia coli* accounted for 8, 7 and 6 VAPs respectively.

CONCLUSION

Central Venous Catheter (CVC) Surveillance

The Welsh critical care infection surveillance scheme provides the critical care teams with an indication of the current Welsh CVC infection rate and details of possible risk factors associated with line insertion / line maintenance. The data provided in this annual report highlights the main results obtained from the data collected and is intended to provide 'head-line' rates only. A more in-depth review of the data will be published in due course.

In particular, the surveillance for 2009 has identified the hospital location where the majority of lines are inserted and the number of infections associated with the insertion location. The majority of lines were inserted on critical care where the highest infection rate was also noted (12 infections). The surveillance has also provided an indication into the organisms associated with infection and this in turn may be linked with line insertion / maintenance locally as well as with antibiotic prescribing. The 2009 results show coagulase negative staphylococci to be the main organism associated with infection. This was also noted in the 2008 CVC annual report⁶. The jugular was the vein most often utilised for inserting a line. This was followed by the femoral vein. Results for 2009 also compare with the 2008 annual report⁶. There has been much debate into the site of line insertion in the literature and the infection risks associated with the insertion site (jugular versus the subclavian vein for example)^{7, 8}. It should be noted that there are currently different practices in Wales for the site of line insertion. Although more data are required, this surveillance should provide an indication into the most common site for line insertion and hence the widespread practice in Wales with corresponding infection rates.

The overall CVC infection rate (utilising HELICS criteria) was 0.7 per 1000 catheter days for 2009 compared with 0.9 per 1000 catheter days for 2008. The rates should be interpreted with some caution as we cannot be sure that all data is being collected by the surveillance scheme. To date we have been unable to provide figures for Health board compliance with the scheme. We are currently setting up a protocol to validate the data collected and importantly to gain a better indication of the percentage of data captured. The all Wales rate provided in this report should be compared with other countries and used as a benchmark for Wales as more data are collected. However, the literature searched to date does not seem to provide many rates overall but instead concentrates on bloodstream infections and or rates by ICU specialty. Catheter-related bloodstream infections range from approximately 1.23 to 4.2 in the literature^{9, 10}.

Ventilator Associated Pneumonia (VAP) Surveillance

The Welsh critical care infection surveillance scheme provides the critical care teams with an indication of the current Welsh VAP infection rate. The report also provides some possible risk factors associated with mechanical ventilation. The data provided in this first annual report highlights the main results obtained from the data collected and is intended to provide 'head-line' rates only. A more in-depth review of the data will be published in due course.

In particular, the surveillance identified the percentage of intubations by the type of case (medical, surgical or trauma) and the number of infections associated with the case type. Approximately 50% of intubations were associated with medical cases with 17 infections noted. The surveillance also provided the number of infections occurring in patients with risk factors such as COPD (7 infections) or diabetes mellitus (5 infections). The surveillance has also provided an indication into the organisms associated with infection and this in turn may be linked with the intubation / maintenance care bundle in place as well as with antibiotic prescribing / therapy. *Pseudomonas sp.* were associated with the highest number of VAPs (total of 9 infections) whilst 8 were attributed to *Candida sp.* *Pseudomonas sp.* have been identified as a major cause of VAPs in other studies^{4, 12}. However, more data are required to confirm the main organisms associated with VAPs in Wales.

The overall VAP infection rate (utilising HELICS criteria) was 2.2 per 1000 ventilator days for 2009. The rates should be interpreted with some caution as we cannot be sure that all data is being collected by the surveillance scheme. Validation of the data will occur in 2011 as previously mentioned under the CVC surveillance conclusion. The all Wales rate provided in this report should be compared with other countries and used as a benchmark for Wales as more data are collected. VAP rates from other countries vary from 1.89 to 5.5 per 1000 ventilator days^{13, 14}. However the latter is preliminary data until a full literature search is undertaken.

To conclude

Careful interpretation of the CVC and VAP results are required when comparing data from other countries. A full description of the methodology is required to search for potential differences in data collection methods and interpretation of infections. For example, many countries utilise the CDC definitions instead of HELICS.

This all-Wales report should be used alongside reports from critical care schemes in other countries. However, Health boards should utilise the bi-monthly and annual Health board reports to compare their own unit rates over time. Continuation of this scheme is required with an indication of surveillance compliance to ensure an accurate all Wales CVC and VAP infection rate is calculated and for accurate all Wales and unit comparison of rates over time.

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ACKNOWLEDGEMENTS

The Welsh Healthcare Associated Infection Programme Team members are grateful to the critical care teams, infection control teams and all others who have provided data for this report. We are also grateful for the support and advice from the Scottish Surveillance of Healthcare Associated Infection Programme.