CRITICAL CARE ANNUAL REPORT

CENTRAL VENOUS CATHETER AND VENTILATOR ASSOCIATED PNEUMONIA

2010

ALL WALES

Author: Welsh Healthcare Associated Infection Programme

Issued Date: 3 August 2011 | **Version:** 1

The Temple of Peace & Health, Cathays Park, Cardiff, CF10 3NW
Y Deml Heddwch ac Iechyd, Parc Cathays, Caerdydd, CF10 3NW
Tel/Ffon: 029 2040 2473
Fax:/Ffacs: 029 2040 2526

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.

INDEX

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 criteria[2]. 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 voluntary 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 hospital[2]. 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 preventable[5]. 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 (with a device in situ), 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 UK[3].

This is the second 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 2010 (1st January 2010 – 31st December 2010). CVC infection and VAP results provided in this 2010 report can be compared with previous annual reports. The report includes data captured using internationally agreed definitions (HELICS) and includes infections associated with critical care units only. 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 (CVC) SURVEILLANCE

ALL WALES SUMMARY

- This report covers the mandatory central venous catheter (CVC) infection surveillance in critical care in Wales (2010). The report covers CVC related infections associated with critical care as defined utilising HELICS criteria.

- A total of 4918 forms were received for the period 01/01/2010 – 31/12/2010. 4883 (99%) of forms could be further analysed for determining the CVC infection rate.

- The results provided for all Wales should be treated with caution until compliance with the surveillance is known.

- A total of 19 infections were recorded by the surveillance with 68% (13 infections) meeting HELICS infection criteria. An overall infection rate of 0.5 per 1000 catheter days was noted for the period 01/01/2010 – 31/12/2010. The mean all Wales rate was 0.4 per 1000 catheter days with a median of 0.4 per 1000 catheter days (Health Board rates varied from 0.0 – 1.1 per 1000 catheter days).

- The overall infection rate broken down by infection type was 0.07, 0.11 and 0.29 per 1000 catheter days for CRI 1, CRI 2 and CRI 3 infections, respectively. The majority of infections noted were categorised as bloodstream (CRI 3).

- The overall monthly CVC infection rate for all Wales varied from 0.0 to 1.3 per 1000 catheter days for the 12 month period. The majority of infections occurred between July and December.

- Approximately 55% of CVC lines were inserted on critical care and approximately 35% in theatre. The majority of line infections were associated with lines inserted on critical care for all Wales and at a Health board level. Of the 13 HELICS infections for Wales, 9 were attributed to critical care, 3 to theatre, 1 to A&E.

- 76% of lines were inserted in the jugular vein, 13% in the femoral vein and 10% in the subclavain vein. The majority of CVC infections were associated with the jugular vein (12). Similar results were also noted at a Health board level.

- Coagulase negative *Staphylococci*, MRSA and *Serratia sp.* were associated with the highest number of HELICS defined CVC infections in Wales. A total of 6 infections were noted with the latter organisms with 4 attributed to lines inserted on critical care.

ALL WALES RESULTS

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

A total of 4918 forms were received for January – December 2010. 4883 (99%) of forms could be utilised for data analysis.

SECTION 1. HELICS defined CVC infection rate

Overall HELICS CVC infection rate

Table 1.1 Overall HELICS defined CVC infection rate for All Wales for the period 01/01/2010 - 31/12/2010

Total number of infections recorded*: 19

Number and percentage of infections that meet the HELICS criteria: 13 (68%)

Number of HELICS CVC infections	Number of critical care catheter days**	HELICS CVC infection rate*** (per 1000 critical care catheter days)
13	28025	0.5

** Where microbiological and clinical signs provided enable an infection to be noted*
*** 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 0.4 per 1000 catheter days with a median of 0.4 per 1000 catheter days (Health Board rates varied from 0.0 – 1.1 per 1000 catheter days).

Incidence of HELICS CVC infections by infection type

Table 1.2 Breakdown of HELICS defined CVC infection rate by infection type for All Wales for the period 01/01/2010 - 31/12/2010

Infection type	Number of HELICS CVC infections	HELICS CVC infection rate*** (per 1000 critical care catheter days)
CRI 1	2	0.07
CRI 2	3	0.11
CRI 3	8	0.29

Incidence of HELICS CVC infections by month

Figure 1.1 HELICS defined CVC infection rate by month for All Wales for the period 01/01/2008 - 31/12/2010

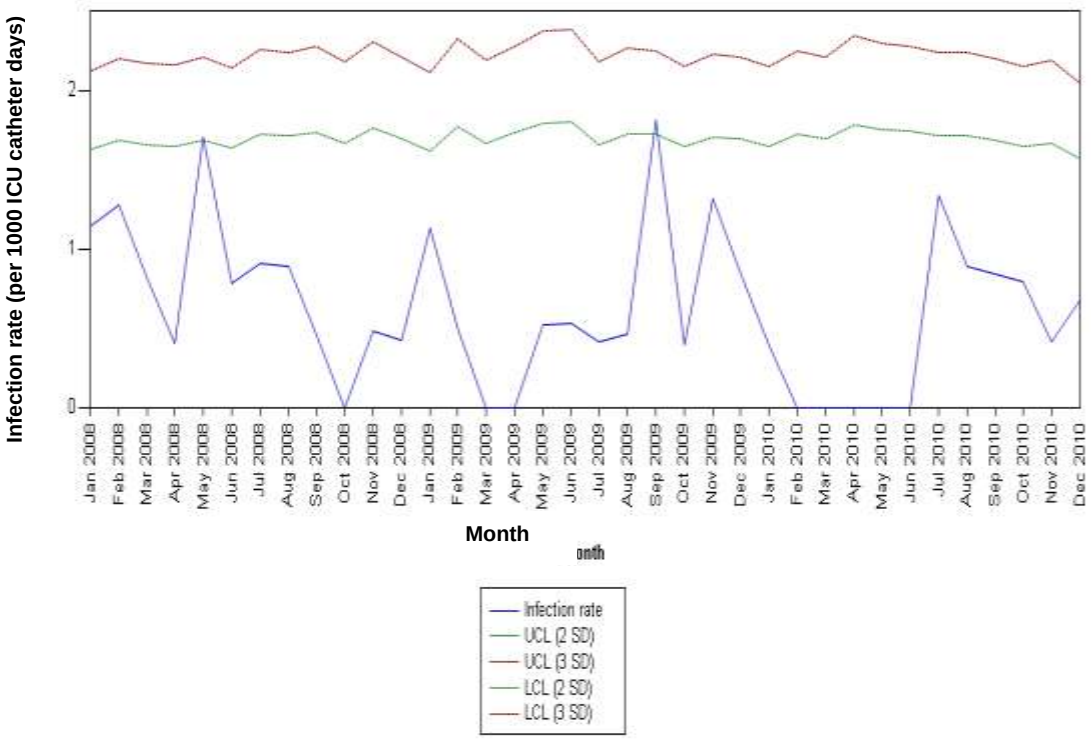
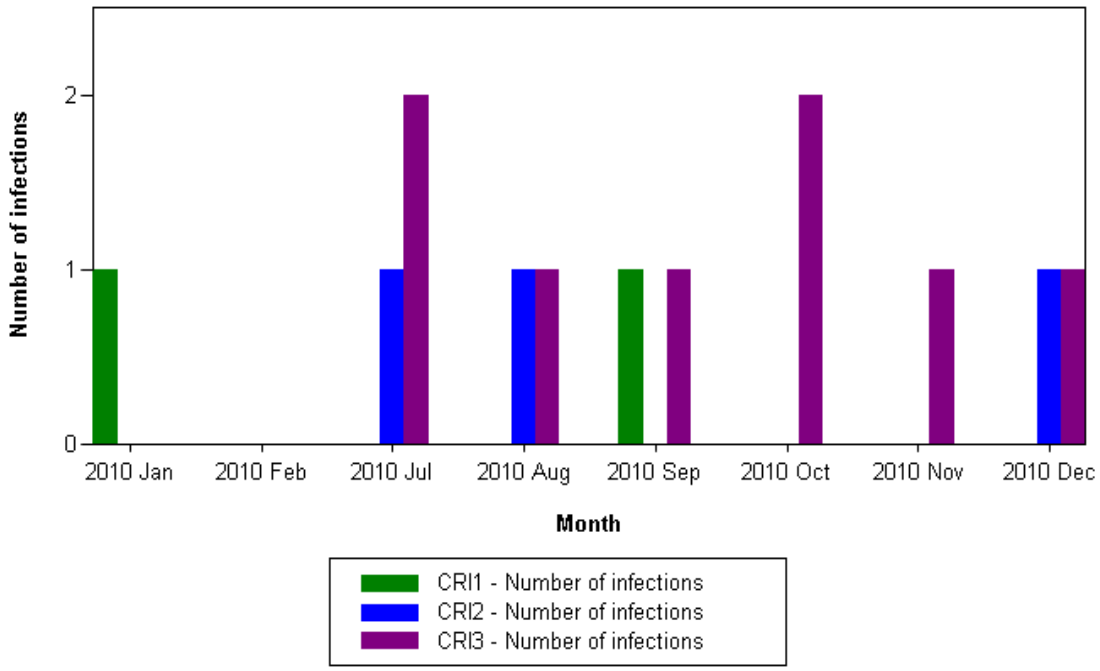


Figure 1.2 Numbers of HELICS defined CVC infections by month and infection type for All Wales for the period 01/01/2010 – 31/12/2010



Key Summary Points

- The total number of infections recorded by the surveillance for the period 01/01/10 – 31/12/10 was 19 however, only 68% of these met with the HELICS defined infection criteria.
- A HELICS defined CVC infection rate of 0.5 per 1000 catheter days was noted for the period 01/01/10 – 31/12/10.
- The mean all Wales infection rates was 0.4 per 1000 critical care catheter days with a median of 0.4 per 1000 catheter days.
- The majority of infections noted were categorised as CRI 3 (bloodstream infections). 8 CRI 3 infections were noted providing a rate of 0.29 per 1000 critical care catheter days.
- The overall monthly infection rate varied from 0.0 to 1.3 per 1000 critical care catheter days over the 12 month period. All infection rates remained 'in control' (below the upper control limits (UCL) at 2 standard deviations (2 SD) and 3 standard deviations (3 SD) above the mean rate) for 2010.
- The majority of infections in 2010 occurred between July and December.
- The results provided for all Wales should be treated with caution until compliance with the surveillance is known.

SECTION 2. Incidence of HELICS CVC infection by hospital location of line insertion and line insertion site

Figure 2.1 Percentage of CVC insertions and numbers of HELICS defined CVC infections by hospital location for All Wales for the period 01/01/2010 – 31/12/2010

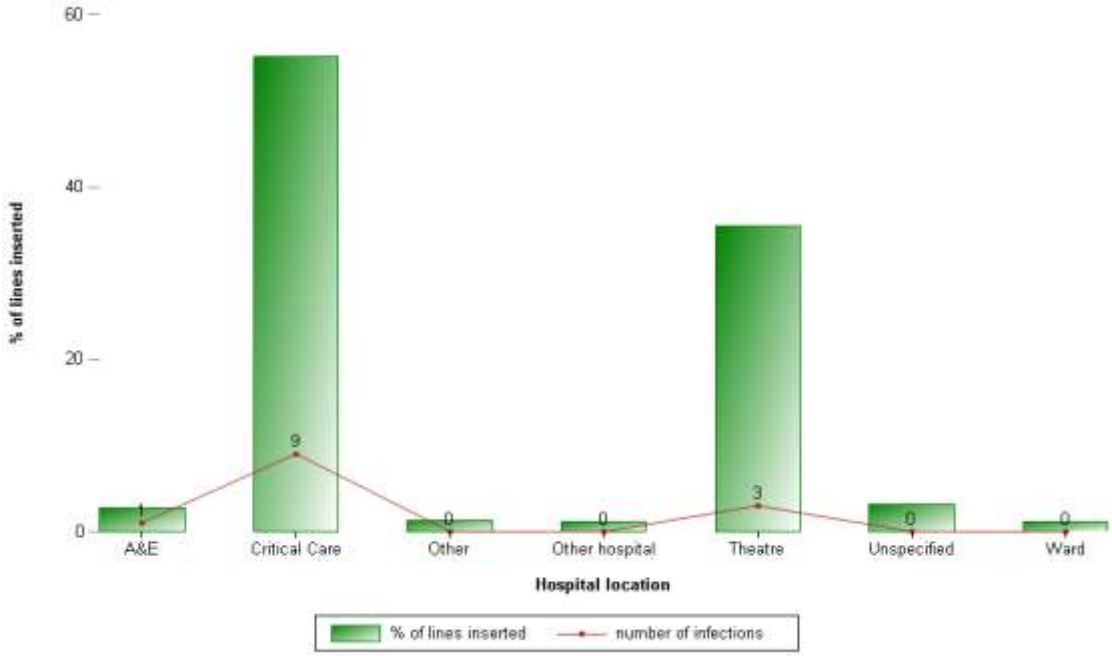
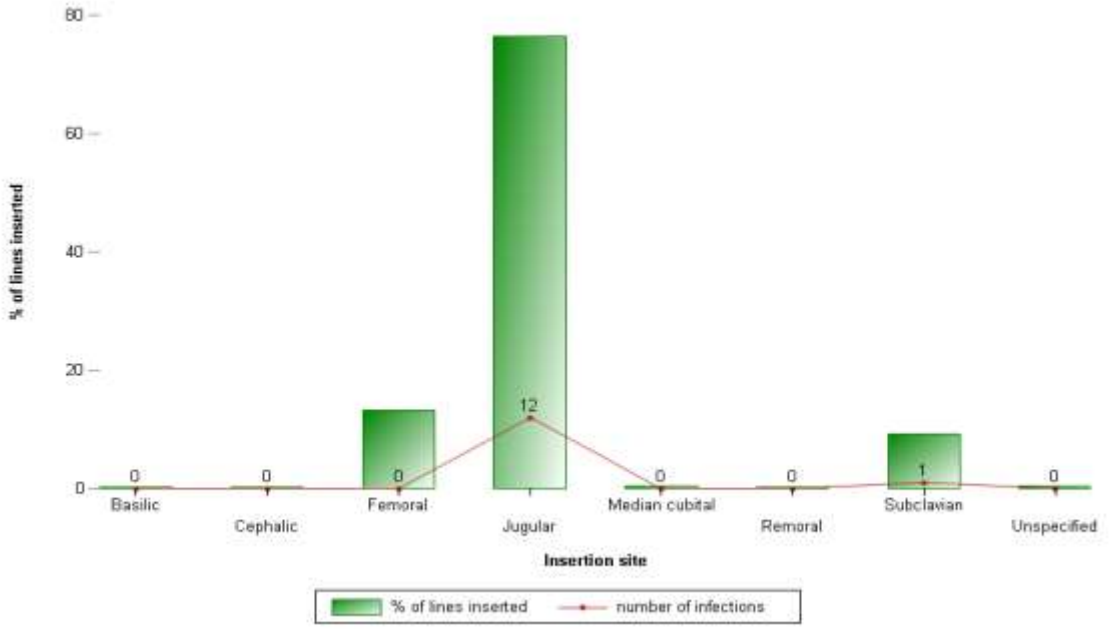


Figure 2.2 Percentage of CVC insertions and numbers of HELICS defined CVC infections by insertion site for All Wales for the period 01/01/2010 – 31/12/2010

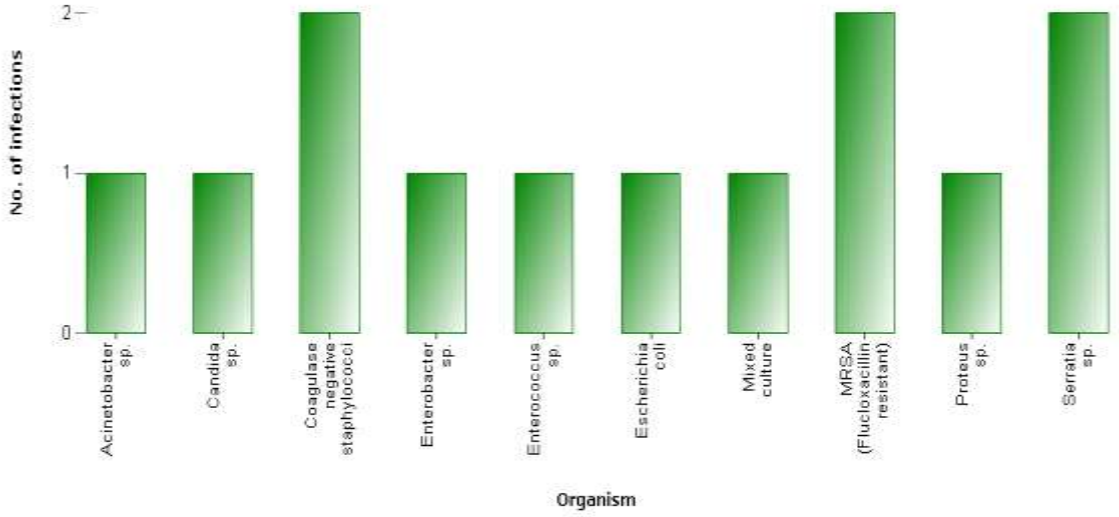


Key Summary Points

- The majority of lines were inserted on critical care (approximately 55%) and in theatre (approximately 35%).
- The majority of HELICS defined CVC infections noted were attributed to lines inserted on critical care (9).
- 3 infections were attributed to lines inserted in theatre and 1 to A&E.
- 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 (12).
- The results noted for Wales were also representative of results at a Health board level.

SECTION 3. Incidence of HELICS CVC infection by organism

Figure 3.1 Numbers of HELICS defined CVC infections by organism for All Wales for the period 01/01/2010 – 31/12/2010



Key Summary Points

- Coagulase negative *Staphylococci*, MRSA and *Serratia sp.* were associated with the highest number of HELICS defined CVC infections. A total of 6 infections were noted with 4 of these attributed to lines inserted on critical care.

VENTILATOR ASSOCIATED PNEUMONIA (VAP) SURVEILLANCE

ALL WALES SUMMARY

- This report covers the mandatory ventilator associated pneumonia (VAP) infection surveillance in critical care in Wales (2010). The report covers VAPs associated with critical care as defined utilising HELICS criteria.

- A total of 2109 forms were received for the period 01/01/2010 – 31/12/2010. 2087 (99%) of forms could be further analysed for determining the VAP rate.

- The results provided for all Wales should be treated with caution until compliance with the surveillance is known.

- A total of 16 VAPs were recorded by the surveillance. An overall VAP rate of 0.9 per 1000 ventilator days was noted for the period 01/01/2010 – 31/12/2010. The mean all Wales rate was also 0.9 per 1000 ventilator days with a median of 1.1 per 1000 ventilator days (Health Board rates varied from 0.0 – 1.3 per 1000 ventilator days).

- The overall VAP rate broken down by VAP type was 0.34 and 0.56 per 1000 ventilator days for PN1 and PN2, respectively. The majority of VAPs noted were categorised as PN2.

- The overall monthly VAP rate for all Wales varied from 0.0 to 2.4 per 1000 ventilator days for the 12 month period. The highest number of infections occurred in March.

- Approximately 52% of intubations were associated with medical cases and approximately 38% with surgical cases. The majority of VAPs were associated with medial cases. Of the 16 VAPs, 11 were associated with medical cases, 4 surgical and 1 trauma. The results noted for Wales were also representative at a Health board level.

- Approximately 30% of cases had a risk factor (15% chronic obstructive pulmonary disease (COPD); 15% diabetes mellitus). In addition 4 infections were associated with these cases, 2 with COPD and 2 with diabetes. The percentage of cases with risk factors noted was similar at a Health board level.

- *Pseudomonas sp.* was associated with the highest number of HELICS defined VAPs in Wales (total of 5 infections). Other organisms associated with more than one infection included *Candida sp.* (2), other Gram negative organisms (2), other *Streptococcus sp.* (3) and *Staphylococcus aureus* (flucloxacillin sensitive) (2).

ALL WALES RESULTS

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.

A total of 2109 forms were received for January – December 2010. 2087 (99%) of forms could be utilised for data analysis.

SECTION 1. HELICS defined VAP rate

Overall HELICS VAP rate

Table 1.1 Overall HELICS defined VAP rate for All Wales for the period 01/01/2010 - 31/12/2010

Number of HELICS VAP	Number of critical care ventilator days*	HELICS VAP rate** (per 1000 critical care ventilator days)
16	17777	0.9

** 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 also 0.9 per 1000 ventilator days with a median of 1.1 per 1000 ventilator days (Health Board rates varied from 0.0 – 1.3 per 1000 ventilator days).

Incidence of HELICS VAP by infection type

Table 1.2 Breakdown of HELICS defined VAP rate by infection type for All Wales for the period 01/01/2010 - 31/12/2010

VAP type	Number of HELICS VAP	HELICS VAP rate** (per 1000 critical care ventilator days)
PN1	6	0.34
PN2	10	0.56

Incidence of HELICS VAP by month

Figure 1.1 HELICS defined VAP rate by month for All Wales for the period 01/01/2009 – 31/12/2010

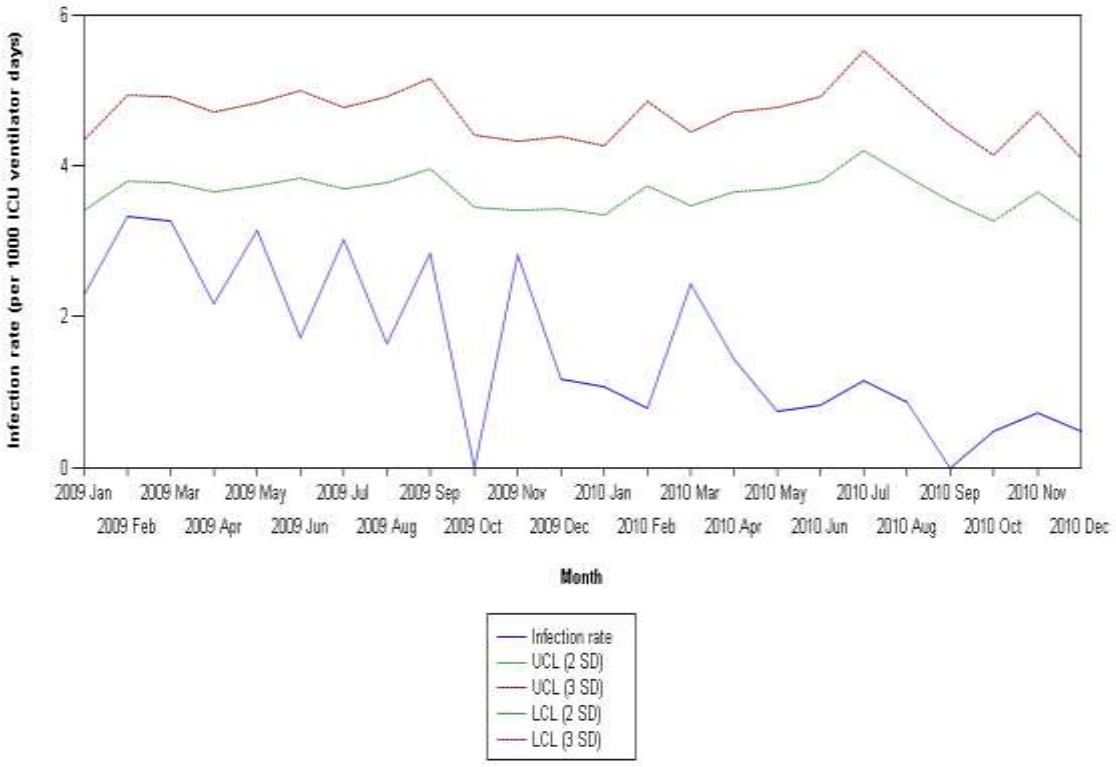
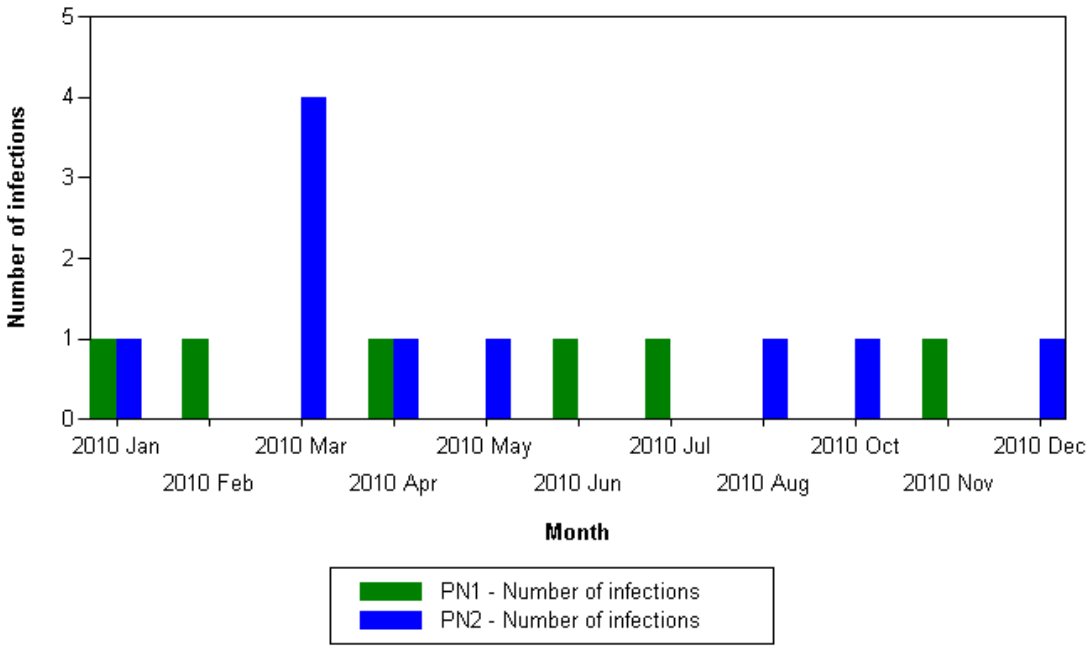


Figure 1.2 Numbers of HELICS defined VAP by month and infection type for All Wales for the period 01/01/2010 – 31/12/2010



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 01/01/10 – 31/12/10 was 16.
- A HELICS defined VAP rate of 0.9 per 1000 ventilator days was noted for the period 01/01/10 – 31/12/10.
- The mean all Wales infection rates was also 0.9 per 1000 critical care ventilator days with a median of 1.1 per 1000 ventilator days.
- The majority of VAPs noted were categorised as PN2 (10) with an infection rate of 0.56.
- The overall monthly infection rate varied from 0.0 to 2.4 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 highest number of infections in 2010 occurred in March.
- The results for all Wales should be treated with caution until compliance with the surveillance is known.

SECTION 2. Incidence of HELICS VAP by case type and risk factor

Figure 2.1 Percentage of intubations and HELICS defined VAP numbers by case type for All Wales for the period 01/01/2010 – 31/12/2010

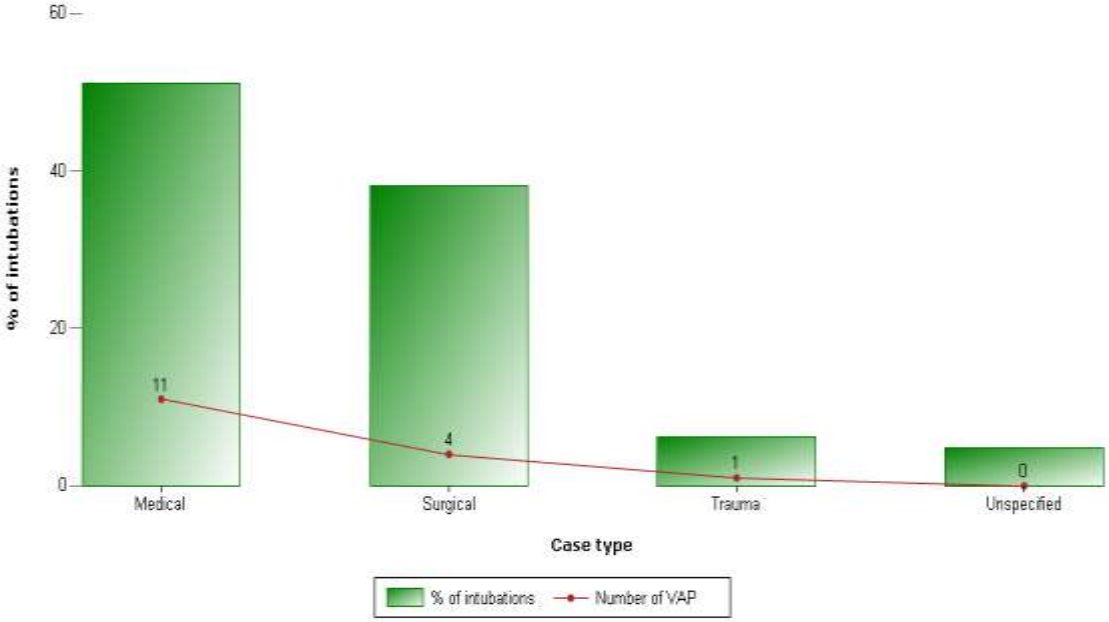
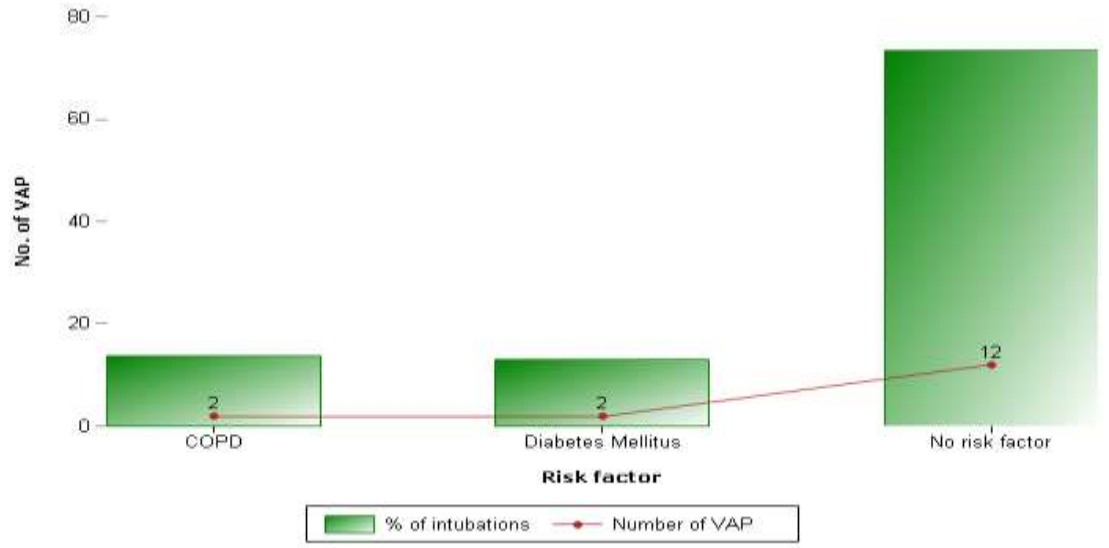


Figure 2.2 Percentage of intubations and HELICS defined VAP numbers by risk factor for All Wales for the period 01/01/2010 – 31/12/2010

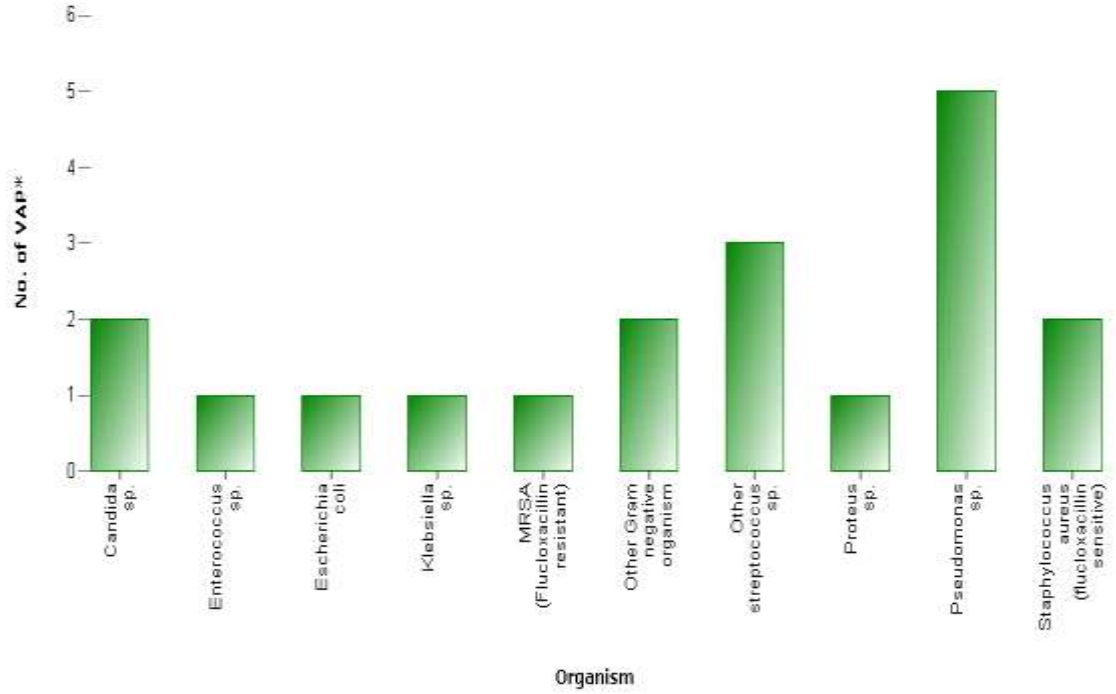


Key Summary Points

- Approximately 52% of intubations were associated with medical cases and approximately 38% with surgical cases.
- The majority of VAPs were associated with medial cases. Of the 16 VAPs, 11 were associated with medical cases, 4 surgical, 1 trauma.
- Approximately 30% of cases had a risk factor (15% COPD; 15% diabetes mellitus). In addition 4 infections were associated with these cases (2 with COPD; 2 diabetes mellitus).
- The results noted for Wales were also representative of results at a Health board level.

SECTION 3. Incidence of HELICS VAP by organism

Figure 3.1 Numbers of HELICS defined VAP by organism for All Wales for the period 01/01/2010 – 31/12/2010



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 5 VAPs were noted.

CONCLUSION

The Welsh critical care infection surveillance scheme provides the critical care teams with an indication of the current Welsh CVC and VAP infection rate. The report also provides some possible risk factors associated with line insertion / line maintenance and mechanical ventilation. 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.

Careful interpretation of the CVC / VAP results is required when comparing data from other countries. A full description of the methodology is required to eliminate differences in data collection methods and interpretation of infections (e.g. CDC definitions vs. HELICS). In addition, Health boards should utilise the bi-monthly and annual Health board reports to compare their own unit rates over time.

Central Venous Catheter (CVC) Surveillance

The overall CVC infection rate (utilising HELICS criteria) was 0.5 per 1000 catheter days for 2010 compared with 0.7 for 2009. The trend in monthly infection rates is also similar when compared with 2009[6] where higher infection rates occurred between June and December. The majority of infections noted for 2010 were categorised as bloodstream infections. The rates should be interpreted with some caution as we cannot be sure that all data is being collected by the surveillance scheme. Compliance with the surveillance will be investigated.

The majority of lines were inserted on critical care where the highest infection rate was also noted (9 infections). The surveillance has 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 results show coagulase negative *staphylococci* and MRSA to be the main organisms associated with infection. The jugular was the vein most often utilised for inserting a line and associated with the highest infection numbers (12).

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[7-9].

Ventilator Associated Pneumonia (VAP) Surveillance

The overall VAP infection rate (utilising HELICS criteria) was 0.9 per 1000 ventilator days for 2010 compared with 2.2 per 1000 ventilator

days for 2009. From the trend graph VAPs were noted for the majority of months. The rates should be interpreted with some caution as previously mentioned under the CVC surveillance conclusion.

Approximately 52% of intubations were associated with medical cases with 11 infections noted. The surveillance also provided the number of infections occurring in patients with risk factors such as COPD (2 infections) or diabetes mellitus (2 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*. was associated with the highest number of VAPs (5 infections). *Pseudomonas sp.* has been identified as a major cause of VAPs in other studies[4, 10].

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. Preliminary literature shows VAP rates from other countries to vary from 1.89 to 5.5 per 1000 ventilator days[11, 12].

REFERENCES

Welsh Assembly Government. Healthcare Associated Infections – A Strategy for Hospitals in Wales. Public Health Protection Division, Welsh Assembly Government, 2007.

Hospital in Europe Link for Infection Control through Surveillance (HELICS). Surveillance of Nosocomial Infections in Intensive Care Units, Protocol Version 6.1, September 2004. HELICS, 2004

Welsh Critical Care Improvement Programme. Interim Report April 2006 – October 2006. National Leadership and Innovation Agency for Healthcare (NLIAH), Wales, 2006.

Salahuddin N, Zafar A, Sukhyani L, Rahim S, Noor M, Hussain K, Siddiqui S, Islam M and Husain S (2004) Reducing ventilator-associated pneumonia rates through a staff education programme. Journal of Hospital Infection 57: 223-227.

Hansen S, Schwab F, Behnke M, Carsauw H, Heczko P, Klavs I, Lyytikäinen O, Palomar M, Riesenfeld Orn I, Savey A, Szilagyi E, Valinteliene R, Fabry J and Gastmeier P (2009) National influences on catheter-associated bloodstream infection rates: practices among national surveillance networks participating in the European HELICS project. Journal of Hospital Infection 71(1): 66-73.

Welsh Healthcare Associated Infection Programme. Critical care surveillance: central venous catheter associated infections All Wales annual report 2009. National Public Health Service Wales, 2010.

http://www.ihi.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/IndividualChanges/OptimalCatheterSiteSelectionwithAvoidanceofFemoralVeinforCentralVenousAccessinAdultPatients.htm (date accessed Aug 2009).

Pronovost P, Needham D *et al.* (2006) An intervention to decrease catheter-related bloodstream infections in the ICU. The New England Journal of Medicine 355(26): 2725-2732.

Tacconelli E, Smith G, Hieke K, Lafuma A and Bastide P (2009) Epidemiology, medical outcomes and costs of catheter-related bloodstream infections in intensive care units of four European countries: literature- and registry-based estimates. Journal of Hospital Infection 72: 97-103.

Leblebicioglu H, Rosenthal V, Arikan Ö, Özgültekin A, Yalcin A, Koksal I, Usluer G, Sardan Y and Ulusoy S (2009) Device-associated hospital-acquired infection rates in Turkish intensive care units. Findings of the International Nosocomial Infection Control Consortium (INICC). Journal of Hospital Infection 65: 251-257.

Kwak Y, Lee S, Kim H *et al.* (2010) Risk factors for device-associated infection related to organisational characteristics of intensive care units:

findings from the Korean Nosocomial Infections Surveillance System. Journal of Hospital Infection 75: 195-199.

Meyer E, Sohr D, Gastmeier P and Geffers C (2009) New identification of outliers and ventilator-associated pneumonia rates from 2005 to 2007 within the German Nosocomial Infection Surveillance System. Journal of Hospital Infection 73: 246-252.

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.