BRITISH COLUMBIA ASSOCIATION OF MEDICAL MICROBIOLOGISTS

Antibiotic Resistant Organism (ARO) Surveillance in British Columbia 2011 Report

The Medical Microbiologists of British Columbia (BCAMM) have established a representative network for gathering surveillance information on AROs in British Columbia. Participating laboratories are from all Health Authorities (HA) in B.C. and include data both in- and out-patients. This is the tenth consecutive year for this report, with yearly cumulative data from 2002 to 2011. Limitations to the interpretation of the data are included in the last section.

This report presents aggregate MRSA and VRE data for the province (Tables 1 and 3), and aggregate MRSA and VRE data by HA (Tables 2 and 4). Where only a single site within a HA submitted data, this site is included with other HA.

The cumulative data from the first 6 years showed a steady increase in the incidence of both MRSA and VRE. The most recent data included in this report is encouraging as it continues to show a downward trend in the number of new patients identified to have MRSA.

Emerging antibiotic resistance in Gram negative bacilli is another area of concern. Eleven sites provided an estimate of the presence of resistance to extended spectrum cephalosporins (known as Extended Spectrum Beta-lactamases, or ESBLs). This data is presented in Table 5. Additionally, data on the presence of a broad range of resistance genes found in Enterobacteriaceae detected by molecular methods is included.

The report is formatted so that individual sites and/or patients can not be identified. After BCAMM review, the report is made available to the Provincial Health Officer, BCCDC Epidemiology, PICNET, CHICA-BC and to others interested in surveillance for AROs. Further use or dissemination of this report should acknowledge the efforts of BCAMM and participants.

We acknowledge the contributions of Medical Microbiologists, General Pathologists, Infectious Disease specialists, laboratory technologists, and infection control practitioners without whom this report would not be possible. While it would be desirable to collect additional demographic or clinical data, or extend the surveillance project to other organisms, this effort would require additional resources.

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Reviewed and approved by BCAMM and all participants

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MRSA reported by BCAMM ARO Surveillance Project

The MRSA data collected for 2011 continues to show a slight decrease compared to 2010 both in the overall incidence of new cases of MRSA and in the percentage of MRSA comprising the proportion of total *S. aureus* isolates. The decreasing trend first seen in 2008 was small, but the trend has continued. Further annual data will be valuable to confirm this downward trend, but the 2011 data continue to suggest that the increased awareness and attention to infection prevention and control is having an impact. This decrease was reported by participating laboratories in most HA.

The trend of new patients identified with MRSA and the approximate proportion of MRSA/total *S. aureus* over the years of this report, and detailed in Table 1, is summarized below:

2002 and 2003: Numbers fairly constant.
2004 to 2007: Steady increase in numbers, **peak year 2007**
2008: 3% decrease from 2007
2009: 13% decrease from 2007
2010: 29% decrease from 2007
2011: 32% decrease from 2007

Table 1: MRSA in BC, collected by BC Association of Medical Microbiologists

Year	Total new MRSA patients[a]	Total *S.aureus* isolates[b]	Approx % MRSA/ Total *S. aureus*[b]	Approx % MRSA -Range[b,c]	Approx % MRSA - Median[b]
2002	2,504	27,641	9.1%	1.3 – 62.7%	NA
2003	3,122	29,991	10.4%	2 – 51%	NA
2004	5,063	33,079	14.4%	6 – 33%	12.3%
2005	8,923	39,471	22.6%	8 – 47%	21%
2006	10,069	43,694	23%	11 – 30%	20%
2007	11,413	50,226	22%	7 – 38%	23%
2008	11,031	52,604	19%	5 – 42%	23%
2009	9,890	48,126	16%	4-32%	23%
2010	**8,088**	**47,220**	**17%**	**4-24%**	**16%**
2011	**7,722**	**50,367**	**15%**	**4-25%**	**15%**

[a] See limitation 1.
[b] See limitation 2.
[c] Numbers at high end of range are outliers and reflect local outbreaks.

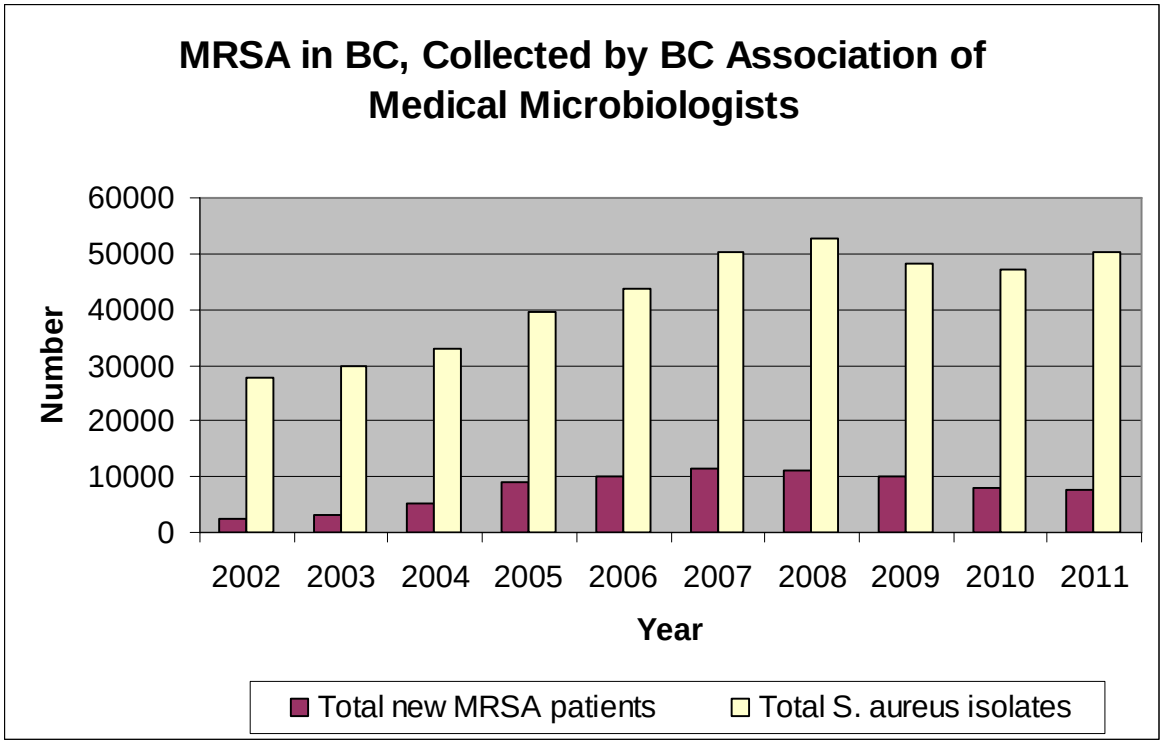

Table 2: MRSA by Health Region, collected by the BC Association of Medical Microbiologists

	2004		2005		2006		2007		2008	
Region	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***
VCH/PHC/ PHSA	1,600	20%	2,263	25%	2,270	24%	1,990	23%	1,769	26%
VIHA South	535	15%	686	24%	314	18%	351	7%	217	5%
FHA	840	12%	2,023	27%	2,229	24%	2,375	31%	2,557	29%
IHA NHA	264	9%	601	15%	745	18%	1,203	21%	1,162	19%
Community Laboratories	1,824	13%	3,350	19%	4,511	24%	5,224	26%	5,326*	20%

*Number corrected from 2008 report

	2009		2010		2011		2012		2013	
Region	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***	**New MRSA patients**	**%MRSA/ All *S.aureus***
VCH/PHC/ PHSA	1,396	19%	1345	19%	1288	19%				
VIHA South	243	6%	287	8%	328	5%				
FHA	2,226	25%	1312	14%	1162	13%				
IHA NHA	1,148	19%	1103	19%	1121	20%				
Community Laboratories	4,877	20%	4041	19%	3823	17%				

VRE Reported by BCAMM ARO Surveillance Project

The VRE data collected for 2011 shows an increase in the overall incidence of new cases of VRE after several years of declining total numbers. Similar to MRSA, further annual data will be needed to monitor the trends. Many sites are moving to policies which decrease the surveillance intensity for VRE, based on local epidemiology and clinical significance in their patients. Future reports may include data from VRE isolated from clinical specimens.

To summarize the data of new patients identified with VRE, detailed in Table 3:

2002 and 2003:	Number of new patients with VRE fairly constant.
2004 to 2008:	Steady increase in numbers, large increases attributed to local institutional outbreaks, **peak year 2008**
2009:	11% decrease from 2008 in number of new patients with VRE
2010:	24% decrease from 2008 in the number of new patients with VRE
2011:	Number of VRE cases back to numbers seen in 2008

With respect to reporting by the community laboratories, VRE continues to be rare in the out-patient setting.

There continues to be a wide range in the incidence of VRE as evidenced by the range of reported cases, from 3 patients with VRE (reported by one site) to a high of 826 patients (reported by one site). The number of patients with VRE reported by many sites still continues to be low, as reflected by the median number of 128 patients by all sites reporting. Eight sites reported more than 60 patients and five sites reported greater than 200 patients. Despite the increase, the prevalence of VRE as a percentage of all enterococci isolated in laboratories is still believed to be low. As in previous years, very few patients with VRE were identified by community laboratories. The large majority of patients with VRE are colonized and the infection rates have remained very low.

Table 3: VRE in BC, collected by the BC Association of Medical Microbiologists

Year	Total new VRE patients[a]	Estimate of VRE as % of all Enterococci[b]	Range: # patients with VRE	Median # patients with VRE by site	Sites reporting >60 patients with VRE
2002	43	<1%			
2003	45*	<1%			
2004	150*	Estimate: no more than 1%			
2005	1,107*	Estimate: no more than 1%	0 – 656	7	5
2006	1,368*	Estimate: no more than 1%	0 – 550	18	7
2007	1,800	Estimate: no more than 1%	1 – 433	8	8
2008	2,588	Low[b]	1 – 514	44	8
2009	2,291	Low[b]	1 - 595	44	7
2010	**1,972**	**Low**	**5-570**	**97**	**5**
2011	**2,562**	**Low[b]**	**3-826**	**128**	**8**

[a] See limitation 1.
[b] See limitation 3. The increase in absolute numbers of VRE and the uncertainly of the denominator makes an estimate unreliable, but it is still considered to be very low.
* Reflects local outbreaks.
**Some institutions have decreased intensity of surveillance for VRE.

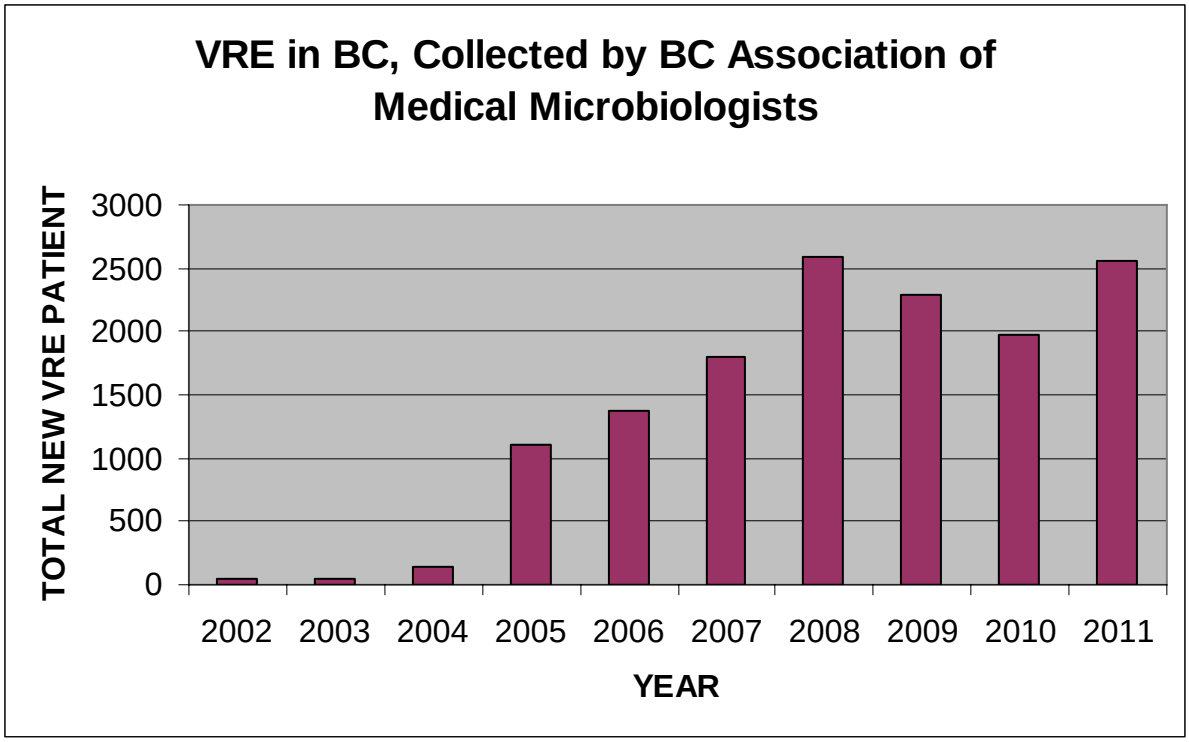

Table 4: VRE by Health Region, collected by the BC Association of Medical Microbiologists

	2005	2006	2007	2008	2009	2010	2011
Region	**New VRE**	**New VRE**	**New VRE**	**New VRE**	**New VRE**	**New VRE**	**New VRE**
VCH/PHC/ PHSA	914	873	913	832	1,131	995	1217
VIHA South	31	17	296	471	243	23*	10
FHA	150	354	436	878	796	697	886
IHA NHA	8	110	149	41	47	217	399
Community Laboratories	4	14	6	67	74	30	50

* Surveillance policy change with less intense surveillance performed

Antibiotic Resistance in Enterobacteriaceae

Results of Phenotypic Testing to Detect Antimicrobial Resistance

ESBLs are extended spectrum beta-lactamases active against newer generation cephalosporins. Most BC laboratories screen for and confirm the presence of ESBL- producing *E. coli* and *Klebsiella pneumoniae* by phenotypic methods according to accepted guidelines. Testing guidelines are not well standardized for other organisms. Twelve sites have reported an approximate percentage (computer systems may not readily track this data) of ESBL producers compared to total *E. coli* and *K. pneumoniae*. The estimated number of ESBL producing organisms appears stable. The percentage varies from 0.7 – 10% for *E. coli* and 0 - 8% for *K.pneumoniae*, and is less for community laboratories when compared to hospital laboratories.

Table 5: Estimated Resistance in Enterobacteriaceae: ESBLs

Year	*E. coli* ESBL estimates	*Klebsiella pneumoniae* ESBL estimates
2007	0.7 to 5%	0 – 3%
2008	1 – 13%	0.3 – 6%
2009 All Laboratories	1-7.8%	0.3 – 6%
2010 All Laboratories	0.7 – 10%	0-8%
2011 All Laboratories	2.5-11%	<1 – 7%
2009 Community Laboratories	1- 1.7%	0.3 -1%
2010 Community Laboratories	0.7 – 2.5%	0.5 %
2011 Community Laboratories	3%	5%

Results of Genotypic Testing to Detect Antimicrobial Resistance

Phenotypic testing methods cannot always identify and differentiate between specific resistance mechanisms, i.e., ESBLs, AmpC (also known as cephalosporinases) and carbapenemases; hence, genotypic methods were implemented at the BCCDC Public Health and Reference Laboratory in the fall of 2010. From October 2009 to October 4, 2012, 450 clinical Enterobacteriaceae isolates, (an additional 327 isolates since the 2010 BCAMM ARO report) were submitted based on unusual phenotypic antibiotic susceptibility profiles that required confirmation. Duplicate isolates from the same source and collection dates were removed for this report. The phenotypic screening methods and decisions for submitting isolates were at the discretion of frontline medical microbiology laboratories.

ESBLs

The gene targets associated with ESBL looked for at BCCDC are not comprehensive, but included SHV, TEM, CTX-M, and OXA-1. ESBL resistance genes continue to be the most common resistance mechanism detected amongst all isolates.

AmpC

BCCDC tests for seven gene targets associated with AmpC resistance, including CMY-2, CMY-1/MOX, CMY-2/LAT, DHA, ACC, MIR/ACT and FOX. Forty-four organisms harboured an AmpC gene only, while the rest were in combination with ESBLs and CREs. The distribution of these by organism is: *E.coli* 15, *Citrobacter spp.* 3, *Proteus spp.* 7, *Morganella spp*. 13, *Enterobacter spp.* 3, *Serratia spp.* 1, *Salmonella spp.* 2

Carbapenem Resistant Enterobacteriaceae (CRE)

BCCDC tests for KPC, NDM, IMP and VIM carbapenem resistance genes. The additional plasmid-encoded carbapenemase gene OXA-48 were tested by NML. To date, 57 isolates carrying any CRE genes were submitted since 2010. There were 35 NDM, 1 NDM+VIM, 2 KPC, 5 VIM, 2 KPC+VIM and 2 IMP, 9 OXA-48 and 1 NDM+OXA-48. Between Jan 2012 and Oct 4, 2012, there were 22 CRE isolates submitted: 15 NDM, 1 NDM+VIM, 3VIM, 1 NDM+OXA-48, 8 OXA-48 and 2 IMP. Note, all isolates carrying OXA-48 genes were *K. pneumonia*e, and they also all harboured the SHV, TEM, CTX-M and OXA-1 genes. Organisms that carried CRE genes included *E. coli, K.pneumoniae, P. aeruginosa, C. freundii, M. morganii, E. cloacae and A. baumannii,* with *K. pneumoniae* being the most common organism. There were 7 *E. coli* and 5 *P.aeruginosa*, with the latter being second most common in 2012. Table 6 summarizes the combination of CRE and ESBL results.

Table 6. Case isolates carrying both ESBL and CRE genes.

	ESBL			
CRE (N=57)	SHV	TEM	CTX-M	OXA-1
KPC	4	3	0	0
NDM	21	23	23	22
IMP	0	0	0	0
VIM	2	2	0	0
OXA-48	10	10	10	10

ARO Surveillance in British Columbia

Limitations:

1. **Number of MRSA and VRE patients:** The patient numbers submitted are those identified at each participating laboratory, each patient counted only once at each site. However, patients may be counted more than once if they submitted cultures to more than one of the participating laboratories. Anecdotally, one large tertiary center found on one annual review that only 2.5% were repeated reports.

2. **Number of isolates:** The number of isolates reported is generated by laboratory information systems. Laboratories use a variety of approaches to count isolates, some of which are chosen according to local need and some of which are dictated by the constraints of the laboratory information system. For example, some laboratories re-test every isolate on a patient (and thus re-count every isolate), while some laboratories have policies which require that the same isolate be re-tested (and thus re-counted) only every four or seven days, depending on the source of the isolate or the location of the patient. Some laboratories only count in-patient isolates. Thus any calculation using the number of isolates tested, e.g. #MRSA/total MRSA tested, is subject to a degree of error.

3. **Number of enterococci**: Denominator data for enterococci is not provided, as the degree of resistance would be largely over-estimated. This is due to the fact that enterococci are common colonizers or are present with other more virulent pathogens. Therefore they are not subject to susceptibility testing and are not counted in laboratory information systems. Alternatively stated, the search for VRE is much more vigilant than the testing and reporting of enterococci in general. The same is not as much of a problem for *S. aureus*, since when *S. aureus* is present in a specimen it is usually considered a pathogen, subjected to susceptibility testing, and is counted. Even with these limitations, it is still fair to estimate that VRE represent comprise a very small percentage of all enterococci isolated in B.C.

4. **Community versus hospital incidence:** Further epidemiologic investigation is required to meaningfully separate the isolates arising from the community or arising in the hospital setting. Breaking the numbers down into those reported by community laboratories and those reported by in-patient settings would not necessarily reflect acquisition in the community, but could be provided if of interest.

5. **Time Period:** Centres may differ on the periods used for counting, some counting on calendar months and others using “periods” within a fiscal year. The data collected were requested for the 12 calendar months or “periods” which best reflect those months, or for the calendar year. This is not felt to introduce significant error into these statistics, as it will be the trend of these data that is most useful.

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ARO Surveillance in British Columbia: Participating Locations

We acknowledge and thank the Medical Microbiologists, General Pathologists, Infectious Disease specialists, laboratory technologists, and Infection Control Practitioners at:

Community-based Laboratories:
1. BC Biomedical Laboratories
2. LifeLabs -Mainland, Vancouver Island, Sechelt, and Gibsons Laboratory locations

Hospital-based Laboratories:
Vancouver Coastal Health:
3. Lion's Gate Hospital, North Vancouver
4. Powell River General Hospital
5. Providence Health Care (St. Paul's Hospital and Mt. St. Joseph's), Vancouver
6. Richmond Hospital
7. Squamish General Hospital
8. St. Mary's Hospital, Sechelt
9. Vancouver Acute (VGH and UBCH sites)

Provincial Health:
10. Children's and Women's Hospital (Vancouver)
11. BCCDC Public Health and Reference Microbiology Laboratory (Vancouver)

Fraser Health:
12. Fraser Health East (Abbotsford Regional Hospital and Cancer Centre, Chilliwack General, Mission Memorial, and Fraser Canyon Hospitals)
13. Fraser Health North (Burnaby, Eagle Ridge, Royal Columbian, and Ridge Meadows Hospitals)
14. Fraser Health South (Surrey Memorial Hospital, Delta Hospital, Surrey Youth Outreach Clinic, Peace Arch Hospital, Langley Memorial Hospital)

Interior Health:
15. Kelowna General Hospital
16. Penticton Regional Hospital
17. Summerland Health Centre
18. South Okanagan Regional Hospital (Oliver)
19. Princeton General Hospital
20. Keremeous Diagnostic Centre
21. Royal Inland Hospital (Kamloops)
22. Vernon Jubilee Hospital

Northern Health:
23. University Hospital of Northern BC

Vancouver Island Health (South):
24. Victoria General Hospital
25. Royal Jubilee Hospital

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