



**BRITISH COLUMBIA ASSOCIATION OF
MEDICAL MICROBIOLOGISTS**

Antibiotic Resistant Organism (ARO) Surveillance in British Columbia 2009 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 from both in- and out-patients. This is the eighth consecutive year for this report, with yearly cumulative data presented from 2002 to 2009. For 2009, data was not received from a few small hospitals previously included but the impact on the trending of data is not considered significant. Limitations to the interpretation of the data are included in the last section.

This report presents aggregate MRSA and VRE data for the entire 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 an adjacent HA. Estimation of whether patients with MRSA were identified from either clinical specimens or from surveillance cultures was provided by most participants and was quite variable. Surveillance specimens identified 2 - 65% of patients newly identified to have MRSA, while clinical specimens identified 35-98%.

The most recent data included in this report is encouraging as it shows a downward trend in the number of new patients identified to have either MRSA or VRE. This is in contrast to the first 6 years of this report which showed a steady increase in the incidence of both AROs.

Community associated MRSA isolates are observed to have increased susceptibility to trimethoprim-sulfamethoxazole. This susceptibility data is included in this report as a surrogate marker of community associated strains. Participants who provided this information reported a range of 82-98% susceptibility to trimethoprim-sulfamethoxazole in MRSA isolates.

Emerging antibiotic resistance in Gram negative bacilli is another area of concern. Participating sites were asked to provide available data on the presence of resistance to extended spectrum cephalosporins (known as Extended Spectrum Beta-lactamases, or ESBLs). Eleven sites were able to provide an estimate of the presence of this resistance pattern. For the first time in this report, data on the presence of resistance genes in Enterobacteriaceae detected by molecular methods is presented.

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 of AROs. Further use or dissemination of this report should acknowledge the efforts of BCAMM and participants.

We acknowledge the Medical Microbiologists, General Pathologists, Infectious Disease specialists, laboratory technologists, and Infection Control Practitioners whose contributions make this report 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.

**Report prepared by Diane Roscoe MD FRCP and Sylvie Champagne MD FRCP
Reviewed and approved by BCAMM**

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MRSA Reported by BCAMM ARO Surveillance Project

The MRSA data collected for 2009 continues to show a decrease 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 data from 2008 to 2009 shows a decline of 1,141 cases, representing a 10% decrease. Further annual data will be needed to confirm this downward trend, but the 2009 data could be an indicator that the increased awareness and attention to infection prevention and control is starting to have an impact. This decrease was reported by participating laboratories in most HA.

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

2002 and 2003: Number of new patients with MRSA fairly constant
 2004 to 2007: Steady increase in number of new patients with MRSA
 2008: Slight decrease from 2007
 2009: 10% decrease from 2008 in number of new patients with MRSA

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

Year	Total new MRSA patients ^a	Total <i>S.aureus</i> isolates ^b	Approx % MRSA/ Total <i>S. aureus</i> ^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%

^a See limitation 1

^b See limitation 2

^c Numbers at high end of range are outliers and reflect local outbreaks

MRSA in BC, Collected by BC Association of Medical Microbiologists

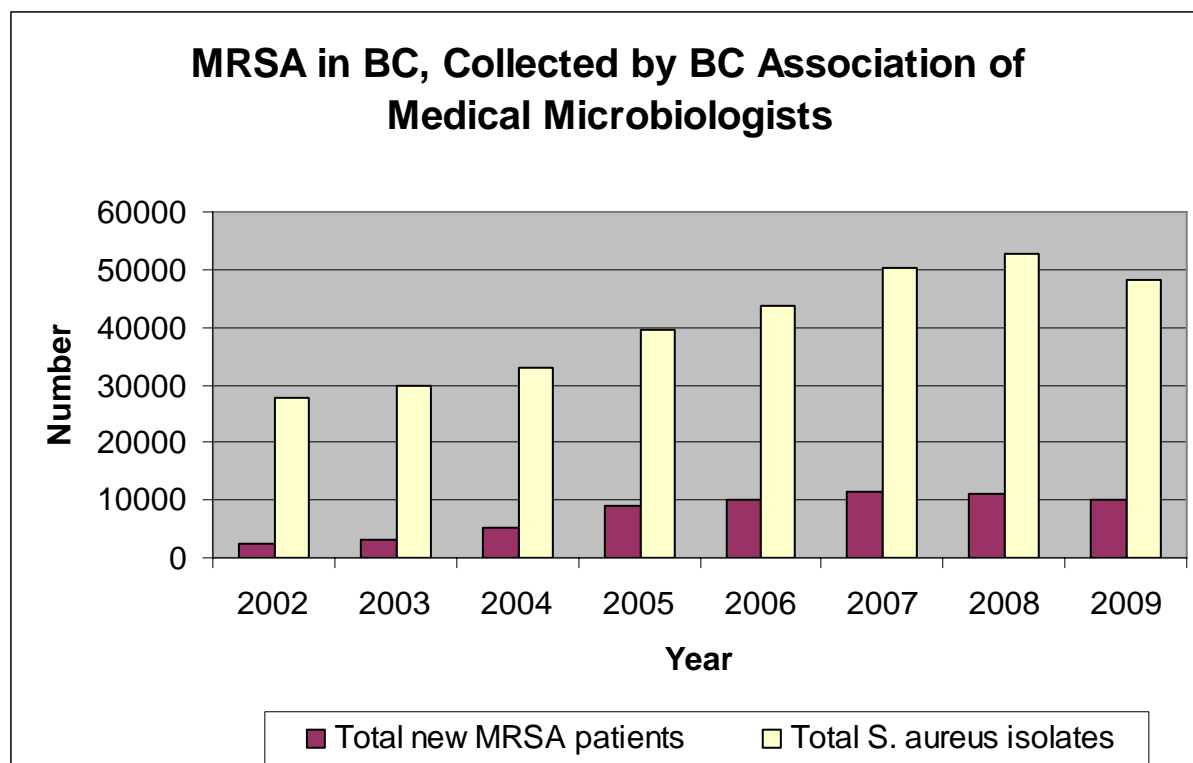


Table 2: MRSA by Health Region, collected by the BC Association of Medical Microbiologists

Region	2004		2005		2006		2007		2008	
	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>
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

Region	2009		2010		2011		2012		2013	
	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>	New MRSA patients	%MRSA/ All <i>S.aureus</i>
VCH/PHC/PHSA	1,396	19%								
VIHA South	243	6%								
FHA	2,226	25%								
IHA NHA	1,148	19%								
Community Laboratories	4,877	20%								

VRE Reported by BCAMM ARO Surveillance Project

The VRE data collected for 2009 shows a decrease in the overall incidence of new cases of VRE. The decrease of 297 cases, represents a 12% decrease from 2008. Similar to the story for MRSA, further annual data will be needed to confirm this downward trend, but the 2009 figures could be an indicator that the increased awareness and attention to infection prevention and control is starting to have an impact. The downward trend may potentially represent facilities reducing the number of VRE surveillance cultures compared to previous years.

To summarize the trend of new patients identified with VRE in Table 2:

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
 2009: 11% decrease from 2008 in number of new patients with VRE

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 incidence of VRE as evidenced by the range of reports from 1 patient with VRE (reported by two sites) to a high of 595 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 44 patients by all sites reporting. Seven sites reported more than 60 patients and five sites reported greater than 200 patients. The prevalence of VRE as a percentage of all enterococci isolated in laboratories is believed to be very 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 with VRE 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

^a See limitation 1

^b See limitation 3. The increase in absolute numbers of VRE and the uncertainty of the denominator makes an estimate unreliable, but it is still considered to be very low.

* Reflects local outbreaks

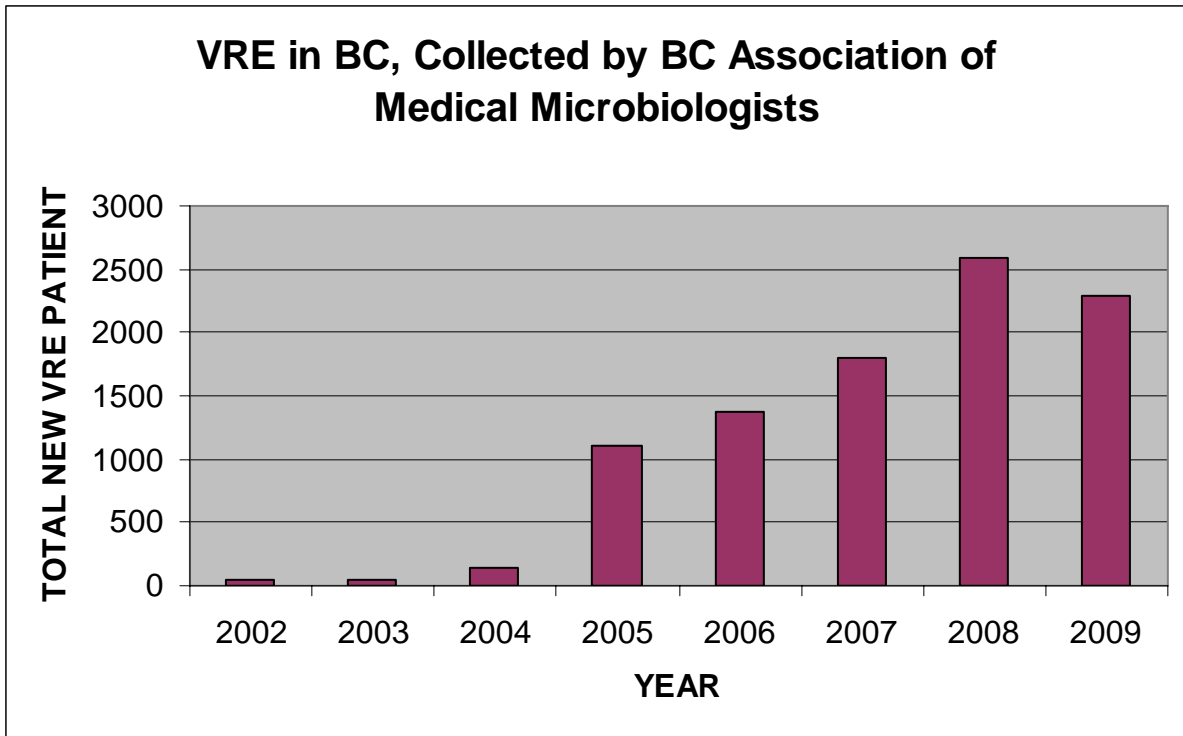


Table 4: VRE by Health Region, collected by the BC Association of Medical Microbiologists

	2005	2006	2007	2008	2009
Region	New VRE patients	New VRE patients	New VRE patients	New VRE patients	New VRE patients
VCH/PHC/PHSA	914	873	913	832	1,131
VIHA South	31	17	296	471	243
FHA	150	354	436	878	796
IHA NHA	8	110	149	41	47
Community Laboratories	4	14	6	67	74

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. Eleven 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 1% - 7.8% for *E. coli* and 0.3 - 6% for *K. pneumoniae*, and is less for community laboratories when compared to hospital laboratories.

Table 5: Estimated Resistance in Enterobacteriaceae: ESBLs

Year	<i>E. coli</i> ESBL estimates	<i>Klebsiella pneumoniae</i> ESBL estimates
2007	0.7 to 5%	0 – 3%
2008	1 – 13%	0.3 – 6%
2009 All Laboratories	1-7.8%	0.3 – 6%
2009 Community Laboratories	1- 1.7%	0.3 -1%

Results of Genotypic Testing to Detect Antimicrobial Resistance

Phenotypic testing methods can not always identify specific mechanisms of 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 December 2010, 39 clinical Enterobacteriaceae isolates were submitted based on unusual phenotypic antibiotic susceptibility profiles that required confirmation. The phenotypic screening methods and decisions for submitting isolates were at the discretion of frontline medical microbiology laboratories. The distribution of isolates included: *E. coli* (14), *K. pneumoniae* (13), *E. cloacae* (6), *S. marscescens* (2), *Serratia sp* (1), *Achromobacter sp* (1), *Enterobacter absuriae* (1) and *Providencia rettgeri* (1)

ESBLs

The gene targets associated with ESBL looked for at BCCDC are not comprehensive, but included SHV, TEM, CTX-M, and OXA-1. In the isolates tested, the most common ESBL genes detected were TEM, CTX-M and OXA-1. ESBL resistance genes were 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. Only 2 *E.coli* isolates harboured AmpC genes alone. All other AmpC positive *E.coli* strains were also positive for ESBL genes. Some AmpC positive/ESBL positive strains also carried carbapenem resistance genes. CMY-2 and CMY-2/LAT were the most common genes detected.

Carbapenem Resistant Enterobacteriaceae (CRE)

BCCDC tests for KPC, NDM, IMP and VIM carbapenem resistance genes. To date, 1 *K. pneumoniae* carrying a KPC gene has been detected and 5 isolates of *E.coli/K. pneumoniae* carrying the newly described NDM gene from 4 patients were identified. These isolates also contained ESBL +/- AmpC genes.



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 % 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 UBC 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 Inland Hospital

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Reviewed and approved by BCAMM. BCAMM also constitutes the BCALP Microbiology Science Section

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