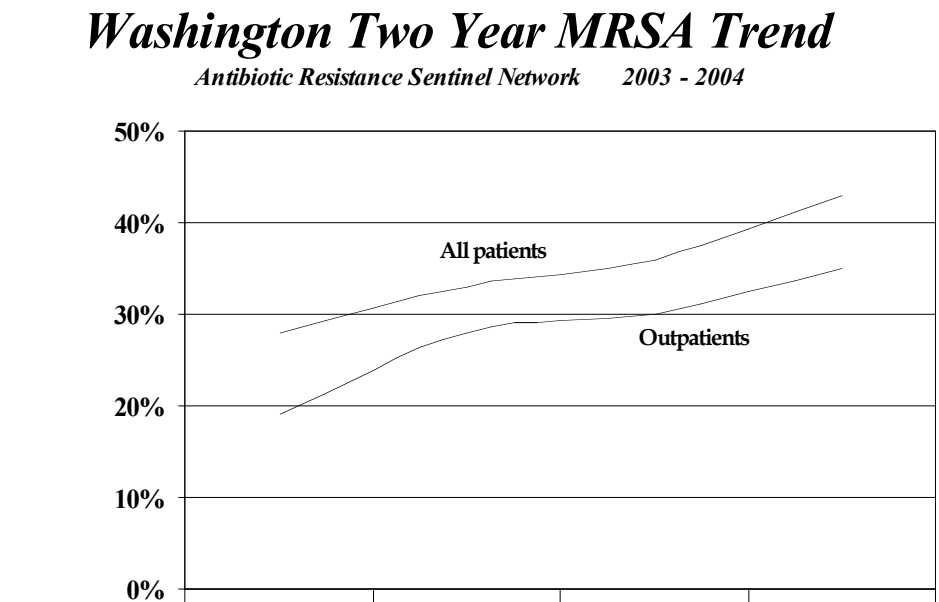
*January 31, 2005*

## Methicillin Resistant *Staphylococcus aureus* (MRSA) Update

*Staphylococcus aureus* resistant to methicillin (and other beta-lactam antibiotics) has become an increasingly prominent concern in most health care settings. MRSA surveillance, management and educational efforts have of necessity been extended from a mainly institutional focus to outpatient settings and to the public. Hospitals and laboratories participating in Washington's Antibiotic Resistance Sentinel Network voluntarily report MRSA laboratory information over bi-annual intervals.

Data aggregated from susceptibility testing indicates a rapid increase over the past two years in the percentage of MRSA among *S. aureus* isolates from 28% to 43%, averaging 8% annually. A similar rate of increase occurred among those specimens coming from outpatients only, from 19% to 35% over two years. (*Figure 1*) During the most recent reporting interval, January through June 2004, 25 facilities serving mixed inpatient and outpatient populations reported test results after isolation of *S. aureus* from 15,748 patient specimens. Among reporting laboratories the proportion of MRSA ranged from 30-64%, with a facility median of 44%. Among reported outpatient specimens, methicillin resistance ranged from 21-46%, with a median of 41%.

***Figure 1***




| | 2002-2nd | 2003-1st | 2003-2nd | 2004-1st |
|---|---|---|---|---|
| — All patients | 28% | 33% | 36% | 43% |
| — Outpatients | 19% | 28% | 30% | 35% |

## MRSA clonal surveillance

At the Washington State Public Health Laboratories (WA PHL), DNA "fingerprinting" of MRSA isolates using pulse-field gel electrophoresis (PFGE) supports epidemiologic investigations into clusters of disease, and also contributes to community MRSA surveillance. By combining DNA "fingerprint" pattern information with microbiologic and epidemiologic data, surveillance seeks to describe circulating MRSA strains and identify those with greatest public health impact. MRSA isolates are submitted from community and institutional outbreaks, infection control surveillance surveys, as well as samples collected to assess institution or community specific patterns. Since 2000, isolates included in the WA PHL collection have been received through 35 different laboratories located in 22 Washington counties.

PFGE patterns (the specific DNA fingerprint) are numbered and organized into clonal groups of closely associated patterns. Washington clonal groups are compared to previously published patterns which have been reported to be predominantly of health care or community origin. The Washington patterns are designated health care-associated (HA) or community-associated (CA) based on previously reported associations. These categorizations correlate well with the origin of isolates tested in Washington when origin of infection onset can be determined.

Through September 2004, 62% of 777 MRSA isolates have been categorized into five clonal groups representing strains that within Washington are relatively frequent, have wide geographic dispersal, and have demonstrated clustering within either health care or community settings (*Table 1*). These clonal groups may indicate strains that have a greater propensity for person-to-person transmission and/or virulence. Identifying their presence in a health care or community setting could promote awareness of an increased potential for outbreak situations.

The clonal groups differ substantially from one another in several important characteristics. Three of the groups are health care-associated and two are community-associated. Among the health-care associated groups, all were found predominantly among older patients (median age 51-73 years) who were hospitalized (77-85%), had MRSA isolated from body sites other than skin or wounds (67% - 73%); and the isolates were often multi-resistant (resistant to three or more classes of antimicrobials in addition to beta-lactams).

The two community-associated clonal groups disproportionately affected younger patients (median ages 28 and 33 yr) and were obtained primarily from skin and soft tissue sources (88% and 90%). True to association described in previously published reports, these were found mainly among outpatients (76% and 81%) and were unlikely to carry antibiotic multi-resistance (7% and 0%). However the majority of community-associated isolates were resistant to two or more classes of antimicrobials, typically beta-lactams, macrolides and/or fluoroquinolones.

The remaining 38% of isolates appear as singular patterns or in small multiples, and these patterns are categorized as sporadic. Although 93% of sporadic isolates had PFGE patterns previously reported to be health-care associated, 76% occurred among inpatients and 24% occurred among outpatients. There is much greater genetic diversity observed among isolates submitted from hospitalized patients,

compared to outpatients, which is consistent with a population of individuals vulnerable to opportunistic infections. Isolates from outpatients exhibited clonal patterns more consistent with transmission of a well-adapted community pathogen. One of the two community-associated strains (SA056 group) dominated in community distribution and accounted for 70 % of all isolates submitted from persons reported to be outpatients. Only 16% of outpatient isolates demonstrated sporadic PFGE patterns, compared to 51% of those from hospital inpatients.

## *Table 1*
## *Characteristics of Washington MRSA Clones*[1]

| ***WA Clonal group*** [1] | ***SA056*** | ***SA027*** | ***SA006*** | ***SA003*** | ***SA041*** | ***Sporadic patterns*** |
|---|---|---|---|---|---|---|
| Origin association [2] | Community | Community | Health Care | Health Care | Health Care | CA: 5%<br>HA 93% |
| USA clonal group[2] | USA 300 | USA 400 | USA 100 | USA 100 | USA 100 | |
| Inpatient % | 24% | 19% | 77% | 85% | 83% | 76% |
| Outpatient % | 76% | 81% | 23% | 15% | 17% | 24% |
| Median Age | 28 yr | 33 yr | 61 yr | 51 yr | 73 yr | 43 yr |
| Source of Isolate<br>SSTI [3]<br>Blood<br>Other | <br>88%<br>7%<br>5% | <br>90%<br>0 %<br>10% | <br>33%<br>9%<br>58% | <br>38%<br>19%<br>43% | <br>27%<br>14%<br>59% | <br>48%<br>10%<br>42% |
| % multi-resistant [4] | 7% | 0 % | 28% | 55% | 75% | 36% |
| Most common resistance profile (in addition to Ox) [5] | E Cp<br>E | E<br>Ox only | E Cp<br>E Cp Cd | E Cp Cd<br>E Cp | E Cp Cd | E Cp Cd<br>E |
| Number of isolates | 312 | 48 | 78 | 28 | 28 | 293 |

[1] DNA fingerprint (PFGE pattern [with up to one band variation]) exhibiting relative frequency, geographic dispersal, and clustering in health care institutions or community.

[2] McDougal LK, Steward CD, Killgore GE. Pulsed-Field Gel Electrophoresis Typing of Oxacillin-Resistant Staphylococcus aureus Isolates from the United States: Establishing a National Database. J Clin Microbiol 2003; 41(11):5113-2.

[3] Skin or soft tissue infection.

[4] Resistant to three or more classes of antimicrobials in addition to beta-lactams.

[5] Resistant to: Ox; oxacillin (representing methicillin, other penicillins and cephalosporins); E, erythromycin; Cp, ciprofloxacin; Cd, clindamycin;

### Antimicrobial susceptibilities

Washington community-associated MRSA strains exhibit less resistance to multiple classes of antimicrobials in general, as has been observed in several published reports. However exceptions to this tendency are common. Among isolates demonstrating resistance to four or more antimicrobial classes, 22% were classified with a community-associated clonal group. Unlike some geographic areas, only 5% of community-associated isolates were resistant to oxacillin alone. Each clonal group exhibits

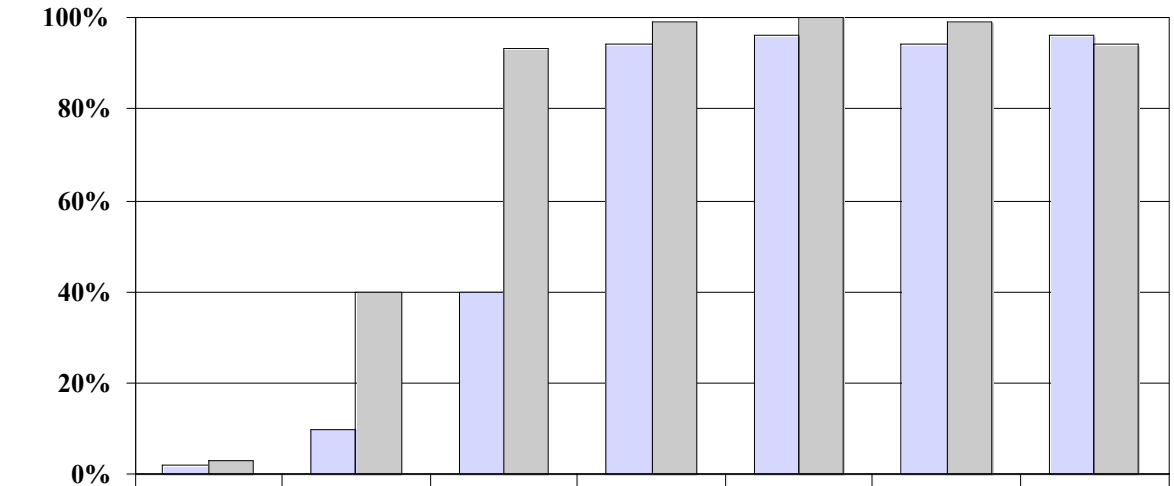
a variety of antimicrobial resistance patterns, and given resistance patterns do not identify any specific clonal group.

Nearly all MRSA isolates submitted for PFGE testing were resistant to erythromycin or another macrolide *(Figure 2)*. Differences are observable between health care and community strains in susceptibility to ciprofloxacin (10% v 40%) and clindamycin (40% v 93%). Overall susceptibility was somewhat decreased in 2004 compared to 2003 for ciprofloxacin (29% v 42%), and for clindamycin (64% v 84%). For clindamycin it is unclear to what extent this change may be attributable to an increase in testing for inducible resistance.

*Figure 2*

## *MRSA Susceptibilities*
## *Health Care versus Community Associated*

***Washington Antibiotic Resistance Sentinel Network 2003*** *- 2004*




| | Erythromycin | Ciprofloxacin | Clindamycin | Gentamicin | Rifampin | Trimeth/Sulfa | Tetracycline |
|---|---|---|---|---|---|---|---|
| HA n=100 | 2% | 10% | 40% | 94% | 96% | 94% | 96% |
| CA n=188 | 3% | 40% | 93% | 99% | 100% | 99% | 94% |

MRSA isolates categorized into Health Care (HA) or Community (CA ) by molecular testing (PFGE)

**Resources** Available through DOH Website http://www.doh.wa.gov/Topics/antibiotics.htm

-Interim Guidelines for Evaluation and Management of Community-Associated Methicillin Resistant *Staphylococcus aureus* Skin and Soft Tissue Infections in Outpatient Settings

-Living with MRSA – a twelve page booklet for patients and their families