



Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infections in the Department of Defense (DOD): Annual Summary Report 2014

NMCPHC-EDC-TR-499-2015

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October 2015

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MRSA Infections in the DOD: Annual Summary Report 2014

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Abstract

Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are a national concern for public health and hospital officials due to the opportunistic nature of the bacteria and the emergence of resistance to several antibiotics. In 2014, the MRSA incidence rates were 60.0 and 70.5 per 100,000 person years in the Department of Defense (DOD) and the Department of the Navy (DON) beneficiary populations, respectively; this is a 56.8% decrease for the DOD and a 60.4% decrease for the DON since 2005. The majority of MRSA infections within the DOD and DON in 2014 were outpatient, community-associated (CA), and skin and soft tissue infections (SSTIs). Among DOD and DON beneficiaries, MRSA isolates were most susceptible to vancomycin, linezolid, and rifampin, and least susceptible to amoxicillin/clavulanate, ceftriaxone, and cefazolin. The proportion of MRSA cases with inducible clindamycin resistance is increasing, with a 30.1% increase in the DOD and a 51.2% increase in the DON from 2005 to 2014. Military prescription practices in 2014 were consistent with treatments recommended by the Infectious Diseases Society of America (IDSA).



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Abbreviated Methods and Case Definitions

The detailed methods for this report are described elsewhere.¹ The EpiData Center (EDC) of the Navy and Marine Corps Public Health Center (NMCPHC) conducted a retrospective surveillance of MRSA infection for January 1, 2014 through December 31, 2014. The results were compared to similar analyses performed in the 2013 report.¹

Health Level 7 (HL7) formatted microbiology data identified *S. aureus* cases resistant to oxacillin, cefoxitin, or methicillin, which classified these isolates as MRSA. A unique MRSA infection was defined as the first MRSA isolate per person per 30 days. Incidence was defined as the first unique infection per person per calendar year and prevalence was defined as all unique MRSA infections. MRSA isolates were matched to HL7 formatted pharmacy data to assess prescription practices, the Standard Inpatient Data Record (SIDR) database to determine healthcare-associated exposures, and the Defense Manpower Data Center (DMDC) active duty (AD) roster to determine the burden of MRSA among DOD AD service members and DON recruits.

Three categories of healthcare exposure were included: hospital onset (HO), healthcare-associated (HA), and CA. An infection was considered HO if the specimen was collected at least four days after the hospital admission date. An infection was considered HA if the individual had a history of hospitalization within the 12 months prior to the specimen collection date for the current infection.² An infection was classified as CA if the specimen was collected within three days of the inpatient admission date, and if there were no other hospitalization records in the 12 months prior to the date of the current MRSA isolate.

An antibiogram was created for the first isolate per person identified in 2014 using antibiotic susceptibility results from the microbiology records according to the Clinical and Laboratory Standards Institute (CLSI) guidelines.³ Inducible clindamycin resistance was determined only when the susceptibility results indicated both erythromycin and clindamycin resistance. The Cochran-Armitage trend test was used to assess patterns in susceptibility from 2005 – 2014.

Outpatient pharmacy data were available beginning in 2006, while unit dose and intravenous data were available from July 2009 forward. Prescriptions were considered related to a MRSA infection if the transaction date in the pharmacy record occurred up to seven days after the specimen collection date. Analyses of prescription practices and pre- and post-culture antibiotic use are limited due to data availability.

To establish a consistent process to identify unnatural variation in annual incidence rates, the Statistical Process Control (SPC) method was used.⁴ For this report, the mean was reset in 2010 due to unnatural variation in MRSA incidence with a significant reduction in cases. The first mean was calculated for calendar year (CY) 2005 – 2009; the second mean was calculated for CY 2010 – 2014.

Results

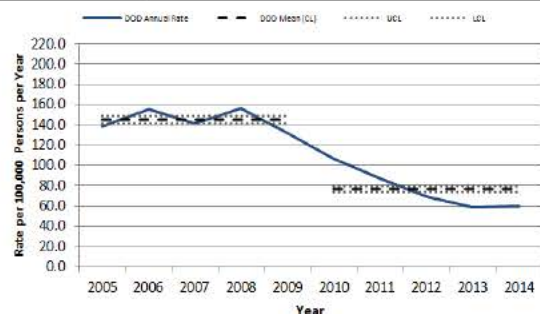
All Beneficiaries – DOD/DON

In 2014, there were 5,555 incident MRSA cases identified among all DOD beneficiaries who were treated at a military treatment facility (MTF), with 1,971 incident cases identified within the DON. The highest incidence rates occurred in 18 – 24 year olds (144.8 persons per 100,000 DOD beneficiaries; 182.6 persons per 100,000 DON beneficiaries), males (72.8; 90.1), Marine Corps beneficiaries (108.1), AD service members (167.8; 182.5), and beneficiaries seen outside the continental United States (OCONUS) TRICARE region (102.4; 154.3).

There were 5,939 prevalent MRSA cases identified among all DOD beneficiaries who were treated at an MTF in 2014, with 2,111 prevalent cases identified within the DON. The largest proportions of prevalence infections appeared in the outpatient setting (91%; 90.7%) as CA infections (83.6%; 85.1%). Overall, 71.7% and 69.1% of all MRSA infections in 2014 were from sources indicative of an SSTI for the DOD and DON, respectively.

Figures 1 and 2 display MRSA incidence rates in the DOD and DON beneficiary populations across the retrospective study period (2005 – 2014):

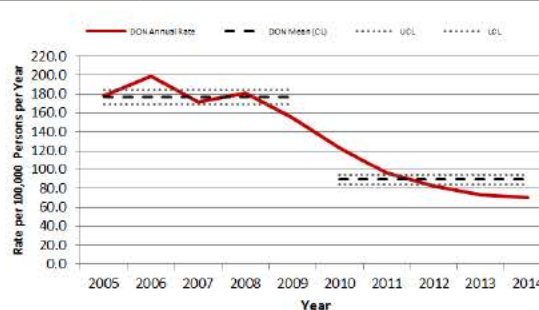
Figure 1. MRSA Incidence Rates Among DOD Beneficiaries, CY 2005 – 2014



Data Source: NMCPHC HL7 formatted microbiology database and MHS M2.

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 20 April 2015.

Figure 2. MRSA Incidence Rates Among DON Beneficiaries, CY 2005 – 2014



Data Source: NMCPHC HL7 formatted microbiology database and MHS M2.

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 20 April 2015.

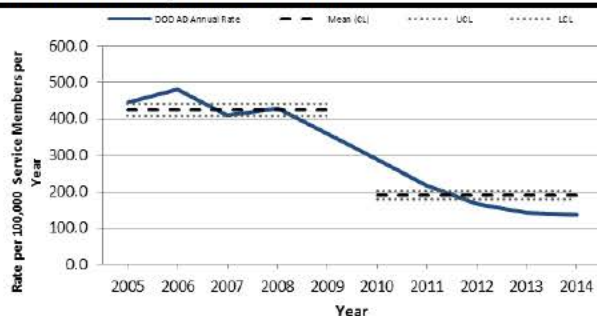
Active Duty – DOD/DON

In 2014, there were 1,900 and 741 incident MRSA cases identified among DOD and DON AD service members, respectively. The highest DOD incidence rates occurred in 17 – 24 year olds (177.4 persons per 100,000 DOD beneficiaries; 185.9 persons per 100,000 DON beneficiaries), females (161.3; 139.4), Marines (210.1), and those in the South TRICARE region (189.5; 191.7). Similar patterns emerged in the DON, except that male AD service members had higher incidence rates (143.5) than females.

There were 2,414 prevalent MRSA cases identified among all DOD AD service members in 2014, with 986 prevalent cases identified in DON AD service members. Infections were mostly identified in the outpatient setting (95.6%; 95.3%), classified as CA (93.7%; 95.4%), and diagnosed as SSTIs (79.7%; 72.5%).

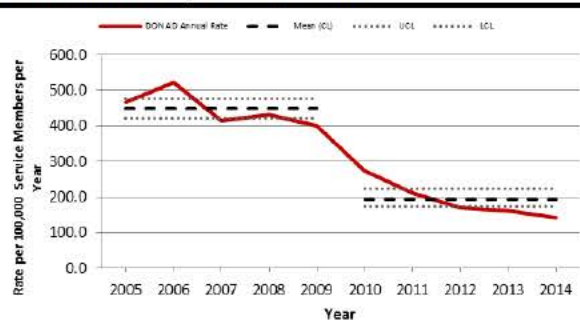
Figures 3 and 4 display MRSA incidence rates in the DOD and DON active duty populations across the retrospective study period (2005 – 2014).

Figure 3. MRSA Incidence Rates Among DOD Active Duty Service Members, CY 2005 – 2014



Data Source: NMCPHC HL7 formatted microbiology database, DMDC, and MHS M2.
 Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 21 April 2015.

Figure 4. MRSA Incidence Rates Among DON Active Duty Service Members, CY 2005 – 2014



Data Source: NMCPHC HL7 formatted microbiology database, DMDC, and MHS M2.
 Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 21 April 2015.

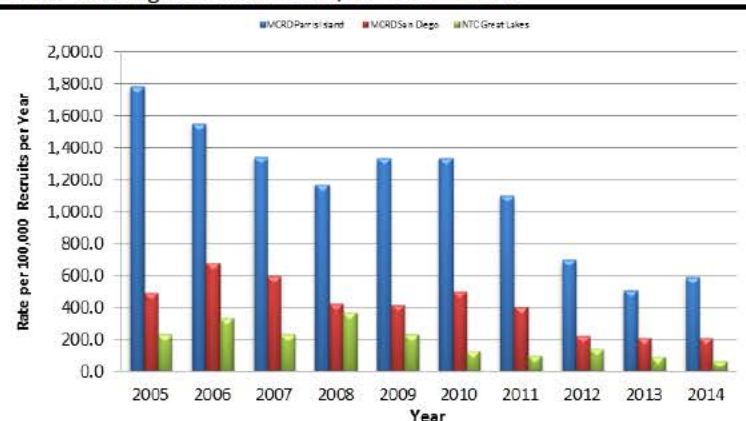
Recruits – DON

In 2014, there were 143 incident MRSA infections identified among DON recruits during the recruit training period; 15.4% of these were Navy recruit cases and 84.6% were Marine Corps recruit cases. Males (164 persons per 100,000 DON recruits), persons aged 18 – 24 years (195.4), and Marine Corps (346.1) recruits had the highest rates of infection. The MRSA incidence rate for Marine Corps recruits was approximately six times the rate for Navy recruits.

All infections among DON recruits in 2014 were CA (100%) and the majority occurred in the outpatient setting (93.1%). Unlike the historical data, in 2014, DON recruits most often had MRSA infections isolated from SSTIs (41.1%).

Figure 5 displays the incidence rates of MRSA infection occurring during basic training in DON recruits across the retrospective study period (2005 – 2014):

Figure 5. Incidence Rates of MRSA Infections Occurring During Basic Training in DON Recruits, CY 2005 – 2014



MCRD Parris Island:^a ↓ 66.9% MCRD San Diego:^a ↓ 57.0% NTC Great Lakes:^a ↓ 73.5%

^a The percent change is used to describe overall trends for each location from 2005 – 2014.

Data Source: NMCPHC HL7 formatted microbiology and DMDC databases.

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 13 April 2015.

Both Navy and Marine Corps recruits exhibited variation in infection rates throughout the 2014 training period (Sailors train for 9 weeks and Marines train for 13 weeks). The early weeks of recruit training had the lowest proportion (21%) of infections; the highest proportion (41%) of infections occurred during the middle weeks of recruit training. The last four weeks of training for each service represented 38% of the recruit infections during training. On average, the length of time to infection was 52 days (eight weeks) into training for Marine Corps recruits and 38 days (six weeks) into training for Navy recruits; these points are just beyond the midpoint of the recruit training period for both services.



Antibiotic Prescription Practices and Susceptibilities

Among DOD and DON beneficiaries, the most commonly prescribed outpatient oral antibiotics for MRSA infections in 2014 were trimethoprim/sulfamethoxazole, clindamycin, and doxycycline. The most commonly prescribed inpatient oral antibiotics were clindamycin, trimethoprim/sulfamethoxazole, and vancomycin. Among intravenous antibiotics, regardless of encounter setting, vancomycin was most commonly prescribed, followed by clindamycin.

DOD MRSA isolates were most susceptible to vancomycin (99.9%), linezolid (99.8%), and trimethoprim/sulfamethoxazole (98.1%). DON MRSA isolates were most susceptible to vancomycin (99.8%), linezolid (99.8%), and rifampin (98.8%). Isolates were least susceptible to ceftriaxone in both the DOD and DON in 2014 (Table 1).

Table 1. Antibiotic Susceptibilities of MRSA Cases within the DOD Population, CY 2014^a

Population			Amoxicillin/ clavulanate	Cefazolin	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Gentamicin	Linezolid	Penicillin	Rifampin	Tetracycline	Trimethoprim/ sulfamethoxazole	Vancomycin
DOD	N = 5,939	% Susceptible	0.7	0.9	0.4	85.8	95.2	17	97.9	99.8	0.1	98.8	95.6	98.1	99.9
DON	N = 2,111	% Susceptible	1.2	0.7	0	87.7	93.1	16.7	98	99.8	0.1	98.8	95.7	98	99.8

^a Only the first MRSA isolate per patient per year was included; excludes surveillance cultures.

Data Source: NCMPHC HL7 formatted microbiology database.

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 22 April 2015.

In 2014, less than 13% of DOD (N = 5,939) and DON (N = 2,111) MRSA cases were resistant to both erythromycin and clindamycin (inducible clindamycin resistance). Overall, the percentage of MRSA cases with inducible clindamycin resistance has increased by approximately 30% since 2005, with a statistically significant trend from 2005 – 2014 ($P < 0.0001$) for both the DOD and DON. Among the MRSA cases with inducible clindamycin resistance in 2014, just over 75% were identified in the outpatient setting for both the DOD and DON, and approximately 60% were CA infections for both populations.



Discussion

Overall, the incidence rates of MRSA in the general United States (US) population, the DOD and DON beneficiary populations, and the DOD and DON AD and recruit populations are decreasing. These trends, along with other indicators in this report, suggest that increased awareness, greater adherence to infection control and prevention strategies, and improved antimicrobial stewardship practices are proving effective in both the civilian and military healthcare communities.

Historically, MRSA was most often seen in the hospital setting, predominately affecting those with established risk factors (i.e., hospitalized, elderly, or immunocompromised). However, recent literature shows that CA MRSA has disproportionately affected groups without typical risk factors, such as children or young adults.^{5,6,7} Within the DOD and DON, the majority of MRSA cases in 2014 were classified as CA (83.6% and 85.1%, respectively). Further analysis revealed that approximately three-fourths of these CA MRSA cases represented individuals under the age of 34. Overall, CA MRSA cases within the DOD and DON follow typical patterns generally observed in the US for CA MRSA.

Within the Military Health System (MHS) in 2014, the highest incidence rates occurred between the months of July and September and generally aligned with the normal variability of typical geographical and seasonal patterns for MRSA. Given the variability of MRSA infections, it was not surprising that differences in MRSA incidence rates emerged for DON recruits training in different geographic locations. As expected, the incidence rate was highest at Marine Corps Recruit Depot (MCRD) Parris Island in South Carolina, which is located in a hotter, more humid climate than the other training depots. The Parris Island rate contrasts with lower rates at MCRD San Diego, which is located in a hotter but drier climate in southern California, and at Naval Training Center (NTC) Great Lakes, which is located in a colder, yet wetter climate in Illinois.⁸ However, incident rates at all recruit training centers continue to decrease overall (Figure 5).

Marine Corps recruits had nearly six times the rate of MRSA infection as Navy recruits in 2014. The military training environment is a close contact environment with intense physical activity, and Marine recruits spend four more weeks in this setting than Sailors, thus increasing their exposure and potentially increasing their risk for infection. In this analysis, nearly 40% of MRSA infections were identified in the last four weeks of training for each service. Recruits may delay care in an effort to complete training, leading to increased rates of infection in later weeks.

Susceptibility patterns of MRSA isolates dictate effective treatment options. There were limited changes to the resistance patterns among MRSA within the MHS in 2014 and, in general, those antibiotics recommended by IDSA for treatment of MRSA remain as viable treatment options for this population. However, clindamycin susceptibility differed drastically between healthcare settings, with lower susceptibility (average 62.4%) in the inpatient setting and higher susceptibility (average 88.1%) in the outpatient setting from 2005 – 2014. This suggests that clindamycin may not be the most viable option for MRSA in the inpatient setting for DOD



beneficiaries due to its reduced susceptibility. Inducible clindamycin resistance also shows a slow increase in the DOD and DON since 2005. Close monitoring of clindamycin susceptibility patterns to MRSA and prescriptions practices is needed to ensure optimal disease prevention and treatment measures.

Current infection control practices appear to reduce the overall burden of MRSA, thereby improving mission readiness through a healthy fleet and force. However, continued surveillance is required to monitor any changes in burden, susceptibility, and treatment options.

Limitations

Detailed limitations associated with this study are described in the Methicillin-Resistant *Staphylococcus aureus* Infections in the Department of Defense: Annual Report 2013.¹



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Acronym/Abbreviation List

Acronym/Abbreviation	Definition
AD	Active duty
CA	Community-associated
CLSI	Clinical and Laboratory Standards Institute
CY	Calendar year
DMDC	Defense Manpower Data Center
DOD	Department of Defense
DON	Department of the Navy
EDC	EpiData Center Department
HA	Hospital-associated
HL7	Health Level 7
HO	Hospital-onset
IDSA	Infectious Disease Society of America
MCRD	Marine Corps Recruit Depot
MHS	Military Health System
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
MTF	Military Treatment Facility
NMCPHC	Navy and Marine Corps Public Health Center
NTC	Naval Training Center
SIDR	Standard Inpatient Data Record
SPC	Statistical Process Control
SSTI	Skin and soft tissue infection
US	United States

