

PATTERNS AND TRENDS IN INVASIVE MRSA IN BALTIMORE, 2004-2007
Preliminary analysis of data from the CDC's Active Bacterial Core surveillance (ABCs) system

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) can cause a range of invasive and potentially life-threatening infections. A recent study of invasive MRSA found that rates in Baltimore exceeded those observed in 8 other US communities.ⁱ We examined MRSA surveillance data to explore trends in invasive MRSA in the city and factors potentially associated with invasive MRSA infection.

METHODS

Data source

Data are from the Maryland component US Center for Disease Control and Prevention's (CDC) Active Bacterial Core surveillance (ABCs) system, an ongoing, population-based, active laboratory surveillance system.ⁱⁱ ABCs personnel identified cases of invasive methicillin-resistant *Staphylococcus aureus* (MRSA) disease among Baltimore residents by routinely contacting microbiology laboratories serving acute care hospitals in the Baltimore area. Standardized case report forms that include information on recent exposure to various health care settings and history of relevant conditions were completed for each identified case.

Invasive MRSA disease was defined as isolation of MRSA from a normally sterile site in a Baltimore resident. A recurrent case was defined as a positive culture result obtained from the same patient 30 days or more after a previous culture in the same calendar year. Recurrent cases are likely to be due to re-infection with the same organism.

Statistical analysis

We analyzed cases cultured from May 2004 through December 2007. We calculated the number and proportion of cases with the following characteristics: history of hospitalization, surgery, dialysis, or residence in a long term care facility in the previous 12 months, presence of an indwelling catheter or current percutaneous medical device at the time of admission, HIV infection, and intravenous drug use (IVDU). Cases could have more than one of these characteristics.

We also calculated unadjusted incidence rates overall and by characteristic. Rates for each characteristic used the entire population as denominators, therefore they can not be used to compare risk between settings. We used Vintage 2007 bridged-race post-censal population estimates from the National Center for Health Statistics for the population denominator data.ⁱⁱⁱ For 2004, we estimated the population denominator to be 2/3 of the full year population.

We calculated counts, proportions, and incidence rates for the entire period, as well as per year (based on the culture date). We calculated two sets of estimates: one using all identified cases, and one excluding recurrent cases in the same patient in the same calendar year. Results using these two methods varied little.

RESULTS

There were 2996 cases identified over the study period for a rate of 127.7 cases per 100,000 per year (Table 1). Among these, 2640 were non-recurrent in a calendar year, for a rate of 112.5 non-recurrent cases per 100,000 per year. Over the entire study period, a hospitalization in the previous year was found in 49% of the non-recurrent cases, previous year surgery history in 18% of cases, invasive device at the time of admission in 32% of cases, previous year residence in a long term care facility in 24% of cases, and previous year dialysis center history in 21% of cases. Considering non-health care characteristics, 28% of non-recurrent cases had a history of intravenous drug use (IVDU) and 19% were HIV-positive.

Rates of invasive MRSA in Baltimore have fluctuated over time since 2004, initially increasing in 2005, then decreasing in 2006 and staying level in 2007. Considering the entire period, rates of non-recurrent cases decreased 11% between 2004 and 2007, from 118.4 per 100,000 in 2004 to 105.3 per 100,000 in 2007 (Table 1).

Considering only non-recurrent cases, rates decreased over time during the study period for all characteristics, except cases among HIV infected individuals (Table 1). For some characteristics, the decrease was quite substantial: -30% for surgery history, -47% for invasive device at admission, -44% for IVDU. Cases with a history of dialysis decreased by -11%. When cases with a history of hospitalization are excluded from those with dialysis history, the rate no longer decreased over time. For cases among HIV infected individuals, an increase of 8% was observed. When cases with a history of hospitalization are excluded from the cases among HIV-positive persons, a 12% increase was observed.

DISCUSSION

This preliminary descriptive analysis of invasive MRSA surveillance data indicates that rates in Baltimore have fluctuated since 2004, first increasing in 2005, then decreasing in 2006 and staying level in 2007. Overall, comparing 2007 to 2004, rates have decreased slightly, however they remain substantially higher than rates reported in other localities.^{iv} During that time period, half of cases were among individuals who had been hospitalized in the previous year. The other factors considered were each present in 20-30% of cases.

There are limitations to conclusions that can be drawn from these analyses. We can not conclude that particular factors are causing invasive MRSA, nor can we conclude that infection control in particular settings or populations will affect invasive MRSA rates. These findings do suggest the need for detailed epidemiologic evaluation of risk factors for invasive MRSA in Baltimore, and highlight the importance of ongoing surveillance and further evaluation of preventive measures in a variety of settings, including hospitals, dialysis centers, long term care facilities, outpatient clinics and other settings.

ACKNOWLEDGEMENTS

We thank the Maryland EIP/ABCs staff for sharing the data with us and Dr. David Blythe, Maryland State Epidemiologist for facilitating the data sharing and for his helpful comments on the report. Data were analyzed by Alisa Ames, MS and Caroline Fichtenberg, PhD of the Baltimore City Health Department's Office of Epidemiology and Planning, with feedback from Dr. Laura Herrera, BCHD Deputy Commissioner and Dr. Joshua Sharfstein, BCHD Health Commissioner. Dr. Fichtenberg drafted the report.

Table 1. Invasive MRSA disease among Baltimore residents, May 2004 to December 2007, according to the CDC's Active Bacterial Core surveillance system

	2004-2007 combined	May-Dec 2004	2005	2006	2007	% change in rate from 2004 to 2007
Total cases	2,996	568	901	762	765	
Yearly case rate (per 100,000)³	127.7	132.9	140.8	118.9	120.0	-10%
Total non-recurrent cases²	2,640	506	798	665	671	
Yearly non-recurrent case rate (per 100,000)³	112.5	118.4	124.7	103.8	105.3	-11%
Among non-recurrent cases, those with:						
Hospitalization in prev. 12 mo						
#	1,283	268	376	303	336	
% of all cases	48.6%	53.0%	47.1%	45.6%	50.1%	
yearly rate (per 100,000)	54.7	62.7	58.7	47.3	52.7	-16%
Surgery in prev. 12mo						
#	479	116	155	87	121	
% of all cases	18.1%	22.9%	19.4%	13.1%	18.0%	
yearly rate (per 100,000)	20.4	27.1	24.2	13.6	19.0	-30%
Invasive device/catheter at admission						
#	852	187	274	243	148	
% of all cases	32.3%	37.0%	34.3%	36.5%	22.1%	
yearly rate (per 100,000)	36.3	43.8	42.8	37.9	23.2	-47%
Long-term care facility (LTCF) in prev. 12mo						
#	641	126	195	176	144	
% of all cases	24.3%	24.9%	24.4%	26.5%	21.5%	
yearly rate (per 100,000)	27.3	29.5	30.5	27.5	22.6	-23%
LTCF in prev. 12 mo. without hosp. in prev. 12 mo.						
#	221	41	64	49	48	
% of all cases	8.4%	8.1%	8.0%	7.4%	7.2%	
yearly rate (per 100,000)	9.4	9.6	10.0	7.6	7.5	-22%
Dialysis in prev. 12mo						
#	542	104	174	126	138	
% of all cases	20.5%	20.6%	21.8%	18.9%	20.6%	
yearly rate (per 100,000)	23.1	24.3	27.2	19.7	21.6	-11%
Dialysis in prev. 12mo without hosp. in prev. 12 mo.						
#	310	43	79	66	65	
% of all cases	11.7%	8.5%	9.9%	9.9%	9.7%	
yearly rate (per 100,000)	13.2	10.1	12.3	10.3	10.2	1%
Intravenous drug use (IVDU)						
#	730	179	235	167	149	
% of all cases	27.7%	35.4%	29.4%	25.1%	22.2%	
yearly rate (per 100,000)	31.1	41.9	36.7	26.1	23.4	-44%
HIV infection						
#	495	73	171	133	118	
% of all cases	18.8%	14.4%	21.4%	20.0%	17.6%	
rate (per 100,000)	21.1	17.1	26.7	20.8	18.5	8%
HIV infection without hospitalization in prev. 12 mo.						
#	276	37	81	73	62	
% of all cases	10.5%	7.3%	10.2%	11.0%	9.2%	
rate (per 100,000)	11.8	8.7	12.7	11.4	9.7	12%

¹ Population denominators were 427,336 for 2004, 640,064 for 2005, 640,961 for 2006, and 637,455 for 2007.

² A non-recurrent case is the first positive culture in a patient in a calendar year.

ⁱ Klevens RM, Morrison MA, Nadle J, et al. Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA*. 2007;298(15):1763-1771.

ⁱⁱ *ibid*

ⁱⁱⁱ United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), 2000-2007 (Vintage 2007) bridged-race postcensal population estimates, on CDC WONDER On-line Database. Accessed at <http://wonder.cdc.gov/bridged-race-v2007.html> on Dec 16, 2008 10:32:38 AM

^{iv} *op. cit.* Klevens RM et al. Rates in the other 8 US communities ranged from 20-50 cases/100,000.