MASSACHUSETTS: A Summary of Select Antimicrobial Resistance Data

The U.S. Centers for Disease Control and Prevention (CDC) has defined the antimicrobial resistance problem as a “major blooming public health crisis.” Drug resistant bacterial infections affect hundreds of thousands of Americans and cause tens of thousands of deaths each year. These infections are painful, difficult to treat, and this ‘silent epidemic’ costs the U.S. health care system many billions of dollars annually. And yet, an astoundingly diminutive amount of federal resources are being committed to address this staggering problem.

Antibiotic-resistant infections have become significant threats to citizens of MASSACHUSETTS:

Drug-resistant Staphylococcus aureus:

- Although primarily affecting ill people in hospitals, Methicillin-resistant Staphylococcus aureus (MRSA), a drug-resistant bacteria, are infecting a growing number of people in the community and outside hospitals, including healthy athletes and children. A recent study in the Journal of the American Medical Association demonstrates that MRSA alone infects more than 94,000 people and kills nearly 19,000 annually in the United States – more deaths than those caused by emphysema, HIV/AIDS, Parkinson’s disease, and homicide. Surveillance for invasive MRSA in Massachusetts reveals rates similar to the national rates.

- Hospitalizations for or complicated by infections caused by MRSA cost nearly double that for non-MRSA stays – $14,000 for MRSA stays compared with $7,600 for non-MRSA stays. The average length of stay in the hospital for a patient with MRSA infection was more than double that for non-MRSA stays – 10.0 days versus 4.6 days.

- Data collected by the Massachusetts Department of Public Health shows that MRSA now accounts for approximately 50% of all S. aureus isolated in hospitals across the state, and a preliminary outside analysis suggests this may be an underestimate.

- In 2005, MRSA accounted for seventy-five percent of all visits made to community health centers for skin infections, up from only 7.7% in 1998. Worse, a recent study at Fenway Community Health Center, a community health center in Boston, documented high rates of a rare but severe, multi-drug resistant MRSA strain which does not respond to several drug classes that are normally effective against MRSA.

Drug-resistant “gram negative” bacterial infections:

2 Dr. Fred Tenover, quoted in “The Bacteria Fight Back” Science, July 18, 2008.
5 Alfred DeMaria, Jr., M.D., Massachusetts Department of Public Health, “Perspectives from Inside and Outside the Health Department,” PowerPoint presentation delivered at the 4th Annual Betsy Lehman Center Patient Safety Conference, December 4, 2007; http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/07conference_demaria.ppt#418,1,Perspectives from Inside and Outside the Health Department
6 Personal conversation with Susan Foster, Alliance for the Prudent Use of Antibiotics, Boston, Massachusetts, January 30, 2008.
• Serious and life-threatening infections due to antibiotic resistant “gram negative” bacteria are on the rise across the United States. Gram negative bacteria primarily are differentiated from gram positive bacteria, like MRSA, by a cell wall that is particularly adept at preventing antibiotics from entering the bacteria. These infections, primarily acquired in hospitals and long term care settings, are extremely difficult to treat and cause significant numbers of illnesses and deaths. Bacteria in this group include: *Escherichia coli* (E. coli), *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, and *Acinetobacter*.

• In March 2009, CDC published guidelines for detection and control of *E. coli* and *Klebsiella* species with increasing resistance to a subclass of antibacterial drugs known as carbapenems. Carbapenems are among the most potent antibiotics currently available and are often considered the “last line of defense” in the treatment of antibiotic resistant bacteria. Studies have shown that the mortality rate from infections caused by carbapenem resistant *Klebsiella* species is roughly 40%. CDC described this problem as “another in a series of worrisome public health developments regarding antimicrobial resistance among gram-negative bacteria [that] underscores the immediate need for aggressive detection and control strategies.”

• Noteworthy, these organisms are difficult to detect with the automated testing systems currently used in most hospital laboratories.

• Of critical importance, there are few to no approved antibacterial drugs currently available to treat many gram negative bacterial infections and few to no new drugs in the pipeline; drug discovery in this area is extremely difficult due to challenges in overcoming the gram negative bacteria’s cell wall.

Other antimicrobial resistance issues:

• According to a study across sixteen Massachusetts communities, one-third of *Streptococcus pneumoniae* isolates in the state are resistant to penicillin and twenty percent could not be treated with other common antibiotics, severely limiting effective treatment, and this trend has continued.

• Additional emerging drug-resistant bacteria in Massachusetts include:
  - *Fluoroquinolone-resistant N. gonorrhoeae*: In Massachusetts, there were 67 cases of fluoroquinolone-resistant *N. gonorrhoeae* in 2006, up from 2 cases in 2001.

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8 CDC MMWR “Guidance for Control of Infections with Carbapenem-Resistant or Carbapenemase-Producing *Enterobacteriaceae* in Acute Care Facilities” March 20, 2009 / Vol. 58 / No. 10

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Drug-resistant Salmonella, a common cause of infectious diarrhea, is being reported with increasing frequency in Massachusetts. There have been outbreaks of Salmonella that are resistant to as many as five different antibiotic classes.

Carbapenem-resistant Klebsiella pneumoniae (CRKP) is a serious and life-threatening multidrug-resistant bacteria that has recently emerged in Massachusetts. Klebsiella Pneumoniae Carbapenemase (KPC) is the enzyme found in CRKP that is responsible for conferring resistance to all but a single very old and very toxic anti-infective agent. CDC has identified Massachusetts as one of four states where KPC-containing organisms frequently occur.13

- Clostridium difficile (C. diff.) is spawning infections in hospitals in the U.S. that can lead to severe diarrhea, ruptured colons, perforated bowels, kidney failure, blood poisoning and death. It is a common cause of antibiotic-associated diarrhea, accounting for 15-25% of all episodes. CDC estimates there are 500,000 cases of C. diff. infection annually in the U.S., contributing to between 15,000 and 30,000 deaths. Elderly hospitalized patients are at especially high risk and mortality in these patients may exceed 10%. The disease is very difficult to treat and recurs in at least 20% of cases, even when treated appropriately.

- Hospitalizations and deaths associated with C. diff. in Massachusetts have increased steadily over the past few years. Between 2000 and 207, here was and over 3-fold increase in C. diff. as a primary diagnosis for hospitalization (12.3 to 38.5 per 1,000 hospital discharges) and a greater than four-fold increase in deaths (39 to 214).14

Public health laboratory capacity:

A key factor in Massachusetts’ ability to detect, monitor and control antimicrobial resistance is its public health laboratory capacity. Across the nation, increasing cases of antimicrobial resistance are currently swamping the ability of each state's public health laboratory to keep pace. There has been limited funding in the past for antibiotic resistance education programs and surveillance, and even this limited funding is on the decrease. Approximately only half of state public health labs can provide some basic resistance testing. Like many states, Massachusetts lacks the targeted technical ability to promptly detect and characterize emerging resistance patterns in a range of pathogens. Therefore, such resistant organisms continue to spread unrecognized and unimpeded throughout the state.

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13 CDC data cited in a July 28, 2008 communication to Senator Sherrod Brown
14 Data: Massachusetts Hospital Discharge Data Set and the Massachusetts Division of Vital Statistics.