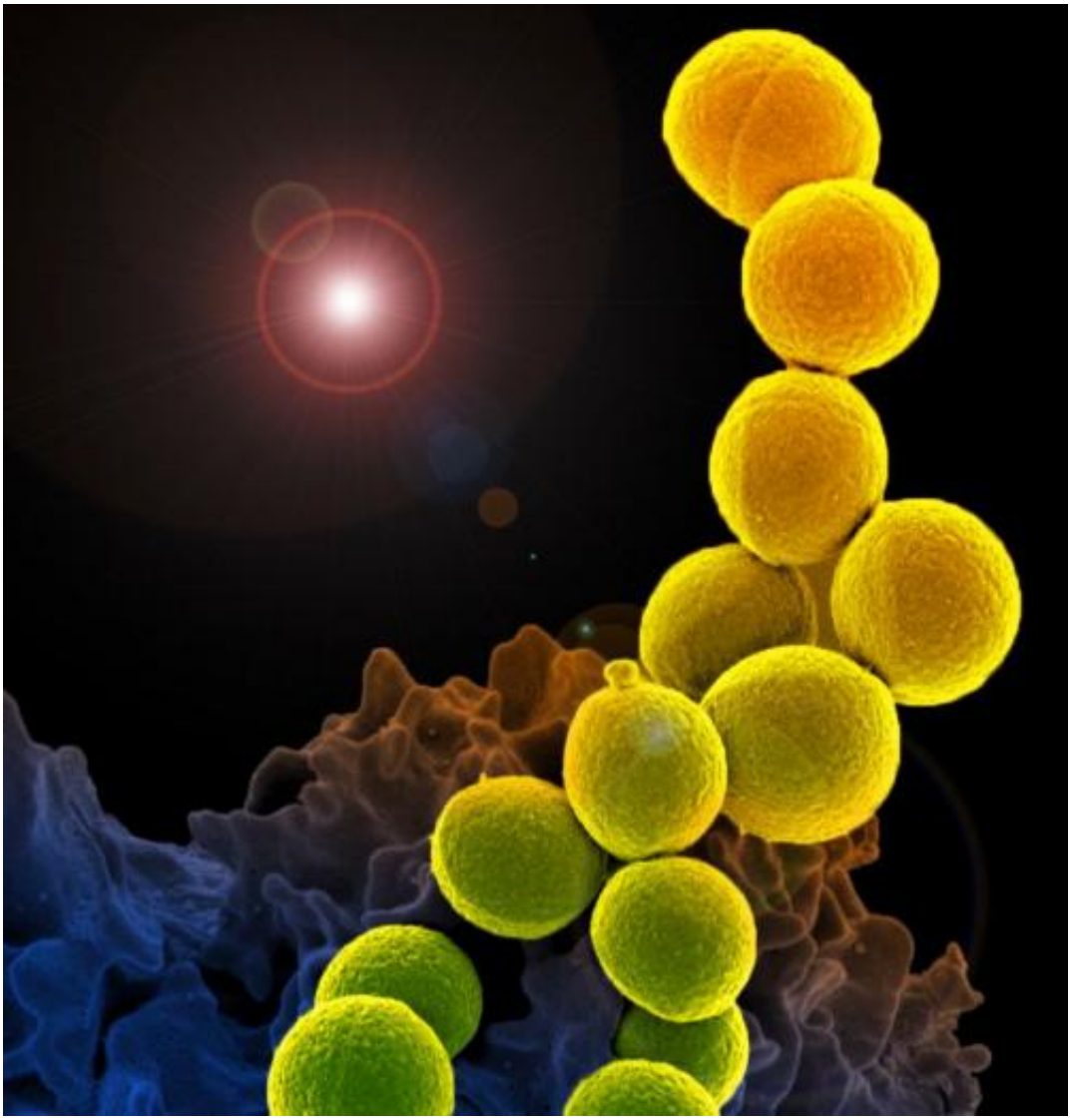
MedicalXpress

MRSA can linger in homes, spreading among its inhabitants

March 10 2015



In this electron micrograph, a white blood cell eats an antibiotic resistant bacteria called methicillin-resistant *Staphylococcus aureus*, or MRSA. Credit: National Institute of Allergy and Infectious Diseases

Households can serve as a reservoir for transmitting methicillin-resistant *Staphylococcus aureus* (MRSA), according to a study published this week in *mBio*, the online open-access journal of the American Society for Microbiology. Once the bacteria enters a home, it can linger for years, spreading from person to person and evolving genetically to become unique to that household.

MRSA are strains of the bacterium *Staphylococcus aureus* that are resistant to almost all antibiotics related to penicillin, known as the beta-lactams. Since the 1990s, community-associated MRSA infections, mostly skin infections, have been seen in healthy people. The predominant community-associated strain of MRSA, called USA300, is virulent and easily transmissible.

For the study, researchers used a laboratory technique called whole genome sequencing on 146 USA300 MRSA samples. These samples were collected during a previous study from 21 households in Chicago and Los Angeles where a family member had presented to the emergency room with a skin infection found to be caused by USA300 MRSA. During that study, published in 2012 in the journal Clinical Infectious Diseases, investigators visited the homes of 350 skin infection patients, culturing their and their family members' noses, throats and groins for bacterial colonization. Among 1,162 people studied (350 skin infection patients and 812 household members), *S. aureus* colonized at one or more body sites of 40 percent (137 of 350) of patients with skin infections and 50 percent (405 of 812) of their household contacts.

For the current study, investigators evaluated the samples to understand transmission dynamics, genetic relatedness, and microevolution of USA300 MRSA within households. They also compared genetic information from these MRSA samples with previously published

genome sequences of 35 USA300 MRSA isolates from San Diego and 277 USA300 MRSA isolates from New York City, as well as with the completed genomes of the bacteria USA300 TCH1516 and FPR3757. They created an evolutionary tree to show the relationships among the bacterial strains.

The researchers found that isolates within households clustered into closely related groups, suggesting a single common USA300 ancestral strain was introduced to and transmitted within each household. Researchers also determined from a technique called Bayesian evolutionary reconstruction that USA300 MRSA persisted within households from 2.3 to 8.3 years before their samples were collected, and that in the course of a year, USA300 strains had a 1 in a million chance of having a random genetic change, estimating the speed of evolution in these strains. Researchers also found evidence that USA300 clones, when persisting in households, continued to acquire extraneous DNA.

"We found that USA300 MRSA strains within households were more similar to each other than those from different households," said senior study author Michael Z. David, MD, PhD, an assistant professor of medicine at the University of Chicago. Although MRSA is introduced into households rarely, he said, once it gets in, "it can hang out there for years, ping-ponging around from person to person. Our findings strongly suggest that unique USA300 MRSA isolates are transmitted within households that contain an individual with a skin infection."

USA300 broke down into two big groups or clades, with the vast majority of isolates from Los Angeles genetically different from those in Chicago. Fluoroquinolone-resistant USA300 clones emerged around 1995 and were more widespread in Los Angeles, San Diego and New York City than in Chicago.

"The study adds to the knowledge base of how USA300 MRSA has spread throughout the country," said study coauthor Timothy D. Read, PhD, an associate professor of infectious diseases at the Emory University School of Medicine in Atlanta. "We're also getting hints at how it evolves inside households. Decolonization of household members may be a critical component of prevention programs to control USA300 MRSA spread in the United States."

Provided by American Society for Microbiology