Association of Environmental Contamination in the Home With the Risk for Recurrent Community-Associated, Methicillin-Resistant \textit{Staphylococcus aureus} Infection

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\textbf{IMPORTANCE} The role of environmental contamination in recurrent \textit{Staphylococcus aureus} infections within households and its potential effect on intervention strategies has been debated recently.

\textbf{OBJECTIVE} To assess whether household environmental contamination increases the risk for recurrent infection among individuals with a community-associated methicillin-resistant \textit{S. aureus} (MRSA) infection.

\textbf{DESIGN, SETTING, AND PARTICIPANTS} This cohort study was conducted from November 1, 2011, to June 30, 2014, in the Columbia University Medical Center catchment area. All patients within 72 hours of presentation with skin or soft-tissue infections and blood, urine, or sputum cultures positive for MRSA were identified. Two hundred sixty-two patients met study inclusion criteria; 83 of these (31.7\%) agreed to participate (index patients) with 214 household members. Participants were followed up for 6 months, and 62 of the 83 households (74.7\%) completed follow-up. Participants and researchers were blinded to exposure status throughout the study. Follow-up was completed on June 30, 2014, and data were assessed from July 1, 2014, to February 19, 2016.

\textbf{EXPOSURE} Concordant environmental contamination, defined as having an isolate with the identical staphylococcal protein A and staphylococcal chromosomal cassette \textit{mec} type or antibiogram type as the index patient’s clinical isolate, present on 1 or more environmental surfaces at the time of a home visit to the index patient after infection.

\textbf{MAIN OUTCOMES AND MEASURES} Index recurrent infection, defined as any self-reported infection among the index patients during follow-up.

\textbf{RESULTS} One patient did not complete any follow-up. Of the remaining 82 index patients, 53 (64.6\%) were female and 59 (72.0\%) were Hispanic. The mean age was 30 (SD, 20; range, 1-79) years. Forty-nine of 61 MRSA infections where the clinical isolate could be obtained (80.3\%) were due to the epidemic strain USA300. Among the 82 households in which a patient had an index MRSA infection, the clinical isolate was present in the environment in 20 (24.4\%) and not found in 62 (75.6\%). Thirty-five patients (42.7\%) reported a recurrent infection during follow-up, of whom 15 (42.9\%) required hospitalization. Thirteen recurrent infections were from the 20 households (65.0\%) with and 22 were from the 62 households (35.5\%) without environmental contamination ($P = .04$). Environmental contamination increased the rate of index recurrent infection (incident rate ratio, 2.05; 95\% CI, 1.03-4.10; $P = .04$).

\textbf{CONCLUSIONS AND RELEVANCE} Household environmental contamination was associated with an increased rate of recurrent infection. Environmental decontamination should be considered as a strategy to prevent future MRSA infections, particularly among households where an infection has occurred.
During the last 3 decades, the number of methicillin-resistant Staphylococcus aureus (MRSA) infections in community settings has increased dramatically. Most infections involve the skin and soft tissues, but 5% to 10% of these infections have been life threatening. Studies have highlighted the household as the primary reservoir for S aureus in the community. Reports have described how epidemic clones bounce among family members, resulting in high rates of recurrent infection. The events that follow an initial community-associated (CA)-MRSA infection in a household include an increase in (1) MRSA found among other household members, (2) contamination of environmental surfaces, and (3) the risk for infection among other household members. The role of the environment in S aureus transmission and infections has been studied in the health care setting and in certain high-risk community settings, such as in injection drug-use sites and prisons. Environmental contamination has been increasingly recognized for its possible role in S aureus transmission and infection within households. The potential importance of environmental contamination in S aureus infection is further supported by the mixed success of body-site decolonization interventions designed to prevent recurrent infections within the household, with recurrent infections often occurring despite best efforts. In the general patient population, the success of MRSA decolonization is highly variable (range, 23%-96%). Alternatively, environmental contamination may simply be a surrogate marker of colonization of multiple body sites or more common among households with multiple infections because infected individuals are more likely to shed bacteria into their environment. We conducted a prospective cohort study designed to determine whether environmental contamination of the household increases the risk for recurrent infection among individuals with a CA-MRSA infection while accounting for competing risk factors.

Methods

Study Population
This prospective cohort study was conducted among patients in the catchment area (defined by surrounding zip codes) of Columbia University Medical Center (CUMC) with a CA-MRSA infection. Data were collected from November 1, 2011, to June 30, 2014. The institutional review board of CUMC approved this study. Written informed consent was obtained from each individual before participation. Parental consent was required for the participation of children younger than 18 years, and pediatric assent was obtained from those capable of providing it.

Study Procedures
Figure 1 summarizes study participant enrollment. Five hundred fifty-four outpatients or inpatients with skin and soft-tissue infections and blood, urine, or sputum cultures positive for MRSA obtained within 72 hours of admission were identified. Patients were ineligible if they were a resident in a long-term care facility, had been hospitalized within the past 6 months, were homeless or living in a shelter, had a chronic illness such as end-stage renal disease, were younger than 1 year, or were a member of a household that already participated in the study. On review of their medical records, 262 patients met the inclusion criteria. We mailed a letter describing the study and attempted to contact these patients by telephone. Of these, 131 (50.0%) could not be reached, 48 (18.3%) refused to participate, and 83 (31.7%) agreed to participate.

Participation involved an initial home visit, during which a structured questionnaire was administered by a trained interviewer (J.K. or J.U.) to the patient with the infection (ie, the index patient) to collect demographic information and assess risk factors for CA-MRSA infection. Potentially sensitive information was obtained using paper-based self-interviewing. All household members who agreed to participate provided the same data as the index patient. After the home visit, monthly follow-up calls were made to the household for 6 months to determine whether any participating household member had an infection in the previous month. One index patient did not complete any follow-up and was excluded from this analysis. The remaining 82 index patients with CA-MRSA infections were included in this analysis; 62 (75.6%) completed follow-up.

The clinical isolates of the index patients were retrieved from the clinical microbiology laboratory at CUMC. At the baseline visit, anterior nares, throat, and inguinal cultures were collected with premoistened swabs (Culturette Systems; Becton Dickinson) from all consenting household members. A standardized list of 11 environmental items were sampled by swabbing the surface area for 30 seconds with premoistened swabs as previously described. In all households, surfaces sampled included door knobs, the television remote, the living room light switch, toys, the couch, the computer or radio, the house telephone or index cellular phone, the bathroom sink, the toilet seat, the kitchen towel, and kitchen appliance handles.

All swabs were processed as previously described. Those isolates that were positive for S aureus underwent staphylococcal protein A (spa) sequencing using Ridom StaphType software (Ridom GmbH). Methicillin resistance was assessed by the presence and type of staphylococcal chromosomal cassette mec (SCCmec) using multiplex polymerase chain reaction analysis. The S aureus isolates characterized as spa type 8 with or without the

Key Points

Question: Does household environmental contamination increase the risk for recurrent infection among individuals with a community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) infection?

Findings: In this prospective cohort study of 82 individuals with CA-MRSA infections, those living in households where environmental items were contaminated with the clinical isolate had twice the risk of developing a recurrent infection compared with those living in households where the clinical isolate was not found in the environment, a significant difference.

Meaning: Environmental decontamination should be considered when attempting to prevent CA-MRSA infections, particularly among households with multiple infected members.
presence of SCCmec were categorized as USA300. All study team members with access to participants were unaware of the results of the environmental samples to minimize differential treatment between households with and without concordant environmental contamination.

Measures
The outcome, index recurrent infection, was defined as any self-reported new infection by the index patient during follow-up, but it did not necessarily occur at a different anatomical site. Medical records of all index patients with a reported recurrent infection were reviewed to determine whether they returned to CUMC for treatment of the reported infection.

The primary exposure, concordant environmental contamination, was defined as an isolate with the identical spa and SCCmec types as the index clinical isolate found on an environmental surface. The primary 2 confounders were defined as having an isolate with the identical spa-type and SCCmec type as the index clinical isolate on the index patient or on a nonindex household member (concordant colonization).

Twenty-one of 82 index clinical isolates (25.6%) were unavailable. When a clinical isolate was unavailable for genotyping and MRSA was present in the household from a human or in the environment (n = 10), antibiogram typing was used to assess strain relatedness between the clinical and colonizing isolates, as previously described. Antibiogram typing has been used for successful screening of MRSA strains in other studies and is performed similarly to spa typing, although it was slightly more discriminatory.

All clinical isolates were analyzed using a PC34 panel (MicroScan; Beckman Coulter) at the time of their initial isolation. The same analyses were run on 1 colonizing MRSA isolate per spa type among cases with a missing clinical isolate and 1 MRSA isolate identified in the household during the home visit. Results were then compared with those obtained from the relevant index clinical isolate. Clinical and household isolates were considered concordant if they had identical results on all biochemical panels (26 tests) and exhibited minimum inhibitory concentration susceptibilities within 1 dilution on all antimicrobial susceptibility panels (12 tests).

To determine whether the clinical isolates unavailable for genotyping (n = 21) were pulsed-field gel electrophoresis type USA300, the results of their biochemical panels and antimicrobial susceptibility panels were compared with biochemical and antimicrobial susceptibility panels on all clinical isolates determined to be USA300 through spa typing. Unavailable clinical isolates whose results fell within the range of values obtained for these clinical isolates were considered to be USA300.

Statistical Analysis
Follow-up was completed on June 30, 2014, and data were analyzed from July 1, 2014, to February 19, 2015. Bivariate analyses of index demographics, household characteristics, and clinical characteristics were compared between households with and without concordant environmental contamination; $\chi^2$ tests and 2-tailed $t$ tests were used for these comparisons. We drew Kaplan-Meier survival curves to compare the rate of recurrent infection among index patients with concordant environmental contamination with the rate among index patients without concordant environmental contamination. Index patients were censored once they were unavailable for follow-up or the study period ended. Curves were compared using the log-rank statistic. To identify variables that might confound the association between concordant environmental contamination and index recurrent infection, we assessed the bivariate association of potential confounding variables (a complete list is found in the Table) with concordant environmental contamination (yes or no) and with recurrent index infection (yes or no). All associations were nonsignificant ($P < .20$). Therefore, no covariates were entered in the Poisson regression model used to estimate the increased rate of index recurrent infection. All statistical tests were 2 sided. Data were analyzed using SAS software (version 9.4; SAS Institute Inc).

Results
Study Population Characteristics
Eighty-two index patients were included in the analyses. The mean age of index patients was 30 (SD, 20; range, 1-79) years, and 53 (64.6%) were female. Fifty-nine patients (72.0%) were Hispanic, 26 (31.7%) had completed high school, 35 (42.7%)
were employed, and 58 (70.7%) reported a household income of less than $21,000 per year. These characteristics reflected the demographics of Northern Manhattan and the South Bronx. The mean household size (including the index patient) was 4 individuals (SD, 2; median, 4; range, 1-9). Nine index patients (11.0%) lived alone.

Index patients were interviewed a mean of 34 (SD, 16; range, 13-104) days after their infection. Index infections involved a variety of body sites, including the lower extremity (n = 25), trunk (n = 21), head and neck (n = 14), axilla (n = 14), upper extremity (n = 13), vaginal area (n = 5), and urinary tract (n = 1). Some individuals had infections at more than 1 body site. Thirty-two index patients (39.0%) reported having an antecedent infection similar to the one that qualified them for participation in this study. At the time of the interview, 4 index patients (4.9%) reported that their infection had not healed. All 4 of these patients stated that the infection had healed by the first follow-up telephone call. Index patients reported making a mean of 2 (SD, 1; range, 1-10) visits to a physician to have the infection treated. Seventy-eight index patients (95.1%) received antibiotics for their infection.

In the 82 households, 214 of 225 nonindex members (95.1%) participated. The mean age of nonindex household members was 26 (SD, 19; range, 0-76) years. One hundred six nonindex household members (49.5%) were female. The Table presents the distribution of sociodemographic characteristics, clinical characteristics, and presence of clinical isolates in the household among those with and without concordant environmental contamination.

### Table. Demographic and Clinical Characteristics and Presence of Clinical Isolates in the Household Among Individuals With CA-MRSA Infections

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Environmental Contamination, No. (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concordant (n = 20)</td>
<td>Nonconcordant (n = 62)</td>
</tr>
<tr>
<td>Demographic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13 (65.0)</td>
<td>40 (64.5)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5</td>
<td>5 (25.0)</td>
<td>6 (9.7)</td>
</tr>
<tr>
<td>5-17</td>
<td>3 (15.0)</td>
<td>9 (14.5)</td>
</tr>
<tr>
<td>18-24</td>
<td>3 (15.0)</td>
<td>11 (17.7)</td>
</tr>
<tr>
<td>25-44</td>
<td>5 (25.0)</td>
<td>18 (29.0)</td>
</tr>
<tr>
<td>&gt;45</td>
<td>4 (20.0)</td>
<td>18 (29.0)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>14 (70.0)</td>
<td>45 (72.6)</td>
</tr>
<tr>
<td>Educational level of high school or less</td>
<td>15 (75.0)</td>
<td>41 (66.1)</td>
</tr>
<tr>
<td>Employed</td>
<td>10 (50.0)</td>
<td>25 (40.3)</td>
</tr>
<tr>
<td>HH income &lt; $21,000</td>
<td>17 (85.0)</td>
<td>41 (66.1)</td>
</tr>
<tr>
<td>HH size ≤ 3 people</td>
<td>11 (55.0)</td>
<td>29 (46.8)</td>
</tr>
<tr>
<td>HH density ≤ 1 person per bedroom</td>
<td>12 (60.0)</td>
<td>37 (59.7)</td>
</tr>
<tr>
<td>Pet in the HH</td>
<td>7 (35.0)</td>
<td>26 (41.9)</td>
</tr>
<tr>
<td>Child &lt; 5 y in the HH (including index patient)</td>
<td>9 (45.0)</td>
<td>23 (37.1)</td>
</tr>
<tr>
<td>Clinical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index skin condition (eg, rash, psoriasis, eczema)</td>
<td>4 (20.0)</td>
<td>18 (29.0)</td>
</tr>
<tr>
<td>Other HH member with a skin condition</td>
<td>7 (35.0)</td>
<td>14 (22.6)</td>
</tr>
<tr>
<td>Time from infection to home visit ≤ 1 mo</td>
<td>9 (45.0)</td>
<td>27 (43.5)</td>
</tr>
<tr>
<td>Index antecedent infection</td>
<td>10 (50.0)</td>
<td>22 (35.5)</td>
</tr>
<tr>
<td>≤ 2 Physician visits to treat infection</td>
<td>5 (25.0)</td>
<td>20 (32.3)</td>
</tr>
<tr>
<td>Index patient received antibiotics for infection</td>
<td>18 (90.0)</td>
<td>60 (96.8)</td>
</tr>
<tr>
<td>Index clinical infection healed by baseline visit</td>
<td>18 (90.0)</td>
<td>60 (96.8)</td>
</tr>
<tr>
<td>Other HH member infection at baseline</td>
<td>11 (55.0)</td>
<td>35 (56.5)</td>
</tr>
<tr>
<td>Presence of clinical isolates in the household</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index patient</td>
<td>15 (75.0)</td>
<td>10 (16.1)</td>
</tr>
<tr>
<td>Other HH member</td>
<td>11 (55.0)</td>
<td>8 (12.9)</td>
</tr>
</tbody>
</table>

Abbreviations: CA-MRSA, community-associated methicillin-resistant Staphylococcus aureus; HH, household.

**Molecular Characterization of Clinical S. aureus Isolates**

Isolates consistent with the epidemic strain USA300 (MRSA t008) were the most common clinical isolate (49 of 61 isolates available [80.3%]) (Figure 2). The remaining 12 clinical isolates (19.7%) belonged to 9 different spa types. Among the clinical isolates classified by antibiogram typing, 13 of 21 (61.9%) were determined to be USA300.

**Presence of the Clinical Isolate on Environmental Surfaces**

Specimens were collected from 884 environmental items among the 82 households, of which 129 (14.6%) were positive for *S. aureus* and 40 isolates were identified as the clinical isolate. Twenty households (24.4%) had the clinical isolate present in the environment. Among these 20 households, 12 had multiple surfaces that were contaminated. The clinical isolate was found on a variety of surfaces (7 bathroom sinks,
6 television remotes, 6 toilet seats, 4 computers, 4 door knobs, 4 kitchen towels, 4 refrigerator handles, 3 couches, and 2 telephones).

**Presence of the Clinical Isolate Among Index Patients**
The clinical isolate was found to be present in 25 index patients (30.4%) at the time of the interview. Among these 25 index patients, the clinical isolate was identified from 16 nasal cultures, 8 inguinal cultures, and 7 throat cultures; 5 of the 25 (20.0%) had the clinical isolate present at multiple body sites. The presence of the clinical isolate in the index patient was more frequent among households with than without concordant environmental contamination (15 of 20 [75.0%] vs 10 of 62 [16.1%]; P < .001).

**Presence of the Clinical Isolate Among Nonindex Household Members**
The clinical isolate was found to be present in a nonindex household member in 19 households (23.2%). Among the 19 households, 27 nonindex household members had the clinical isolate, including multiple members in 7 households. Among these 27 nonindex household members, the clinical isolate was identified from 17 nasal cultures, 12 inguinal cultures, and 8 throat cultures; 9 of the 27 nonindex household members (33.3%) had the isolate present at multiple body sites. The presence of the clinical isolate among nonindex household members was more frequent among households with than without concordant environmental contamination (11 of 20 [55.0%] vs 8 of 62 [12.9%]; P < .001).

**Recurrent Infection Among Index Patients**
Thirty-five index patients (42.7%) reported a recurrent infection during the follow-up period. Index patients reported a recurrent infection at the following proportions and intervals: 10 (12.2%) at baseline to less than 1 month; 9 (11.0%) at 1 to less than 2 months; 3 (3.7%) at 2 to less than 3 months; 5 (6.1%) at 3 to less than 4 months; 10 (12.2%) at 4 to less than 5 months; and 7 (8.5%) at 5 to 6 months (completion of the study). Fifteen of the 35 index patients with a reported recurrent infection (42.9%) were treated for an MRSA-positive infection at CUMC around the time of their report. During a follow-up home visit, we collected specimen data for 23 of the 35 index patients who reported a recurrent infection (65.7%). In 13 of these 23 index patients (56.5%), an isolate with the identical spa type and SCCmec type as the index clinical isolate was present. Four patients (11.4%) had the recurrent infections at the same site as the initial infection, all of which had healed by the initial home visit. Recurrent index infections were more common among households with than without concordant environmental contamination (13 of 20 [65.0%] vs 22 of 62 [35.5%]; P = .04).

**Figure 3** shows the occurrence of these recurrent infections, taking into account censoring. Index patients in households with concordant environmental contamination had less mean follow-up time than index patients in households without concordant environmental contamination (127 vs 141 days), although the difference was not statistically significant (P = .36). The incident rate of recurrent infection among index patients in households with concordant environmental contamination was 0.15 infections per month of follow-up compared with 0.08 infections per month of follow-up among index patients in households without concordant environmental contamination, for an incident rate ratio of 2.05 (95% CI, 1.03-4.04; P = .04).

**Infections Among Nonindex Household Members**
Twenty-seven of 214 nonindex household members (12.6%) from 15 of 82 households (18.3%) reported infections during the follow-up period. Six nonindex household members reported a recurrent infection by 1 month (2.8%); 4, by 2 months (1.9%); 3, by 3 months (1.4%); 1, by 4 months (0.5%); 6, by 5 months (2.8%); and 7, by 6 months (completion of the study) (3.3%). Infections among nonindex household members were not more common among households with than without concordant environmental contamination (5 of 20 [25.0%] vs 10 of 62 [16.1%]; P = .51).

**USA300**
We compared the isolates that caused clinical infection between those classified as USA300 (n = 62) and all other strain types (n = 20). During the household visit, USA300 was less likely to be found on the index patient (19 [30.6%] vs 6 [30.0%]; P = .96), on a nonindex household member (16 [25.8%] vs 3 [15.0%]; P = .32), or in the environment (16 [25.8%] vs 2 [10.0%]; P = .46) compared with all other clinical isolates. Index patients with clinical infections caused by USA300 were not significantly more likely to experience a recurrent infection compared with index patients with clinical infections caused by any other strain type (26 of 62 [41.9%] vs 9 of 20 [45.0%]; P = .81).
Discussion

This prospective cohort study found that household environmental contamination was associated with an increased risk for recurrent infection among individuals who experienced a CA-MRSA infection. Index patients living in households where environmental items were contaminated with the clinical isolate developed recurrent infections at twice the rate of index patients living in households where the clinical isolate was not found in the environment. In contrast, body site colonization with the clinical isolate by either the index patient or other household members did not independently increase the risk for recurrent infection. This finding suggests that the contamination of household surfaces plays a role in recurrent CA-MRSA infection.

These findings add to the accumulating evidence demonstrating the contribution of environmental contamination to the transmission of \textit{S aureus} in community settings by creating a reservoir for infection in the home. This study builds on an earlier retrospective household-based investigation that found environmental contamination with the clinical isolate to be associated with an increased likelihood of antecedent MRSA infection. A subsequent study showed that environmental contamination with the clinical isolate was also associated with an increased likelihood of \textit{S aureus} transmission among household members. Eells et al reported that infection isolates were detected in households 3 months after infection. This finding was associated with body site colonization of household members with the infection isolate. A recent longitudinal study further supported the role of household fomites as a risk for recurrent infections.

The results of this study demonstrate the high burden of \textit{S aureus} among households with a recent CA-MRSA infection. Nearly half of the index patients reported a recurrent infection during the 6-month follow-up, a large portion of whom required additional treatment. This rate is similar to what has been observed in other studies. Persistence of the clinical infection isolate in the household is also similar to what has been observed in other studies.

Strains consistent with the epidemic strain USA300 were responsible for most of the clinical infections and MRSA strains found in households in this study. This trend has been noted in earlier reports. Conflicting evidence exists regarding whether USA300 is more likely than other CA-MRSA strains to spread or cause recurrent infection among households in the community. The results of this study do not suggest that USA300 is better able to colonize body sites or survive in the environment compared with other CA-MRSA strains. Patients infected with USA300 were not at a higher risk for experiencing recurrent infection. Further research is needed to more directly weigh the benefits of using strain-targeted interventions to reduce the burden of \textit{S aureus} in the community.

Our findings suggest the importance of considering environmental contamination when designing interventions aimed at reducing recurrent CA-MRSA infections. In the health care setting, several studies have shown that increased environmental cleaning reduces the amount of MRSA in the environment, although the benefit to the patient remains controversial. Household-based studies have investigated the efficacy of different interventions to reduce the incidence of recurrent infections. Although these interventions have been partially successful in reducing colonization,
rent infections have continued. These studies used decolonization of nonindex household members; however, they have not included environmental decontamination. Further research is needed to determine whether effective decolonization of the household environment of MRSA-infected patients reduces the risk for subsequent infection.

The strengths of this study are that it used a longitudinal cohort design where participants and researchers were blinded to exposure status to answer a directed research question about whether household environmental contamination is an independent predictor of recurrent infection among patients with a CA-MRSA infection. We accounted for numerous other potential risk factors for recurrent infection in our analyses, including body site colonization. To ensure that body site colonization was accurately measured and thus its potential contribution accounted for, multiple body sites were sampled.

This study also has limitations. First, the results are representative of a single, predominantly Hispanic community in Northern Manhattan and the South Bronx, where most of the index patients were female and thus may have reduced generalizability. Second, the outcome measure, index recurrent infection, was based on self-report by a consenting household member, not a clinical assessment. However, medical records were reviewed to determine whether the index patients who reported a recurrent infection were treated at CUMC. Third, the study could have been strengthened by including more detailed information on the treatment experience of the patient, including class of antibiotic prescribed, adherence, and decolonization therapy. Fourth, not all of the clinical isolates were available for these analyses. However, the molecular techniques that were used to assess strain relatedness in the absence of having the clinical isolates previously have been used with success. Whole genome sequencing would further strengthen this study. Fifth, the study could have been improved by reducing the time between infection and the household visit. In addition, owing to limitations of time and enrollment, the targeted sample size (n = 228) was not achieved. Last, most of the clinical infections among our sample were caused by USA300. Therefore, our ability to make comparisons among strain types was limited by this lack of heterogeneity.

Conclusions

Despite limitations, our findings suggest that household environmental contamination increases the risk for recurrent infection among individuals with an index CA-MRSA infection. Environmental decontamination should be considered as a strategy to prevent CA-MRSA infections.

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Study concept and design: Knox, Sullivan, Miller, Shi, Uhlemann, Lowy.
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REFERENCES


Cleaning House—Environmental Contamination in the Home

Mitchell H. Katz, MD

Recurrent Staphylococcus aureus infections are a major problem. In their report on an intensive environmental investigation of the homes of persons diagnosed with community-acquired methicillin-resistant S aureus (MRSA) published in this issue of JAMA Internal Medicine, Knox and colleagues¹ found that the clinical isolate that caused the initial infection could be cultured from the surfaces of 24.4% of the homes, including television remotes, door knobs, computers, and couches. Of greater importance, patients from houses where MRSA could be cultured were twice as likely to develop a recurrent infection.

However, before we instruct our patients with MRSA to decontaminate their houses, remember this is a small preliminary study. Of the 35 patients who had recurrent infection, only 13 (37%) had contaminated homes. Of the 20 with contaminated homes, 7 (35%) did not develop a recurrent infection. We do not know that those who developed recurrences acquired the second infection from their home. Those with contaminated homes may have shed more bacteria owing to more severe infections and the more severe infections may have led to the recurrences. Most important, we do not know if it is possible to decontaminate a home of MRSA. It is hard enough to decontaminate a hospital room with nonporous surfaces. Thinking of my own home inhabited by 2 messy children and 2 not-so-neat adults, I cannot imagine how we would even begin to decontaminate the couch. Still, we should understand the potential sources of recurrent infections and keep an open mind about what can and cannot be prevented.

Conflict of Interest Disclosures: None reported.