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Methicillin-resistant *Staphylococcus aureus*: The Effects are More than Skin Deep

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Abstract

Objectives—To assess the psychosocial effects of a methicillin-resistant *Staphylococcus aureus* (MRSA) diagnosis on the households of children with MRSA skin and soft tissue infection (SSTI).

Study design—We constructed and administered an interview to the primary caregiver within the home of a child with a history of MRSA SSTI.

Results—Seventy-six households were enrolled. Survey responses were analyzed and grouped into four themes: health behavior changes, disclosure, social interactions, and knowledge/awareness. The most common theme was disclosure; 91% of participants reported sharing their child's MRSA diagnosis with someone outside of the household. Forty-two percent of respondents reported a change in the manner in which household contacts interacted as a result of the index patient's MRSA diagnosis, including isolating the index patient from other children in the household. Many households reported adopting enhanced personal hygiene behaviors and environmental cleaning routines. Thirty-eight percent of participating households reported altering how they interact with people outside of their home, largely to avoid spreading MRSA to vulnerable individuals. Additionally, many participants perceived that others regarded them with caution, especially at daycare, while other affected households were excluded from family gatherings.

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Conclusion—Primary caregivers of children with MRSA SSTI reported changing their health behaviors, altering their interactions with people outside of their home, and feeling isolated by others in response to their child's MRSA diagnosis. The findings of our study highlight a need for community interventions and education to prevent the negative psychosocial repercussions associated with MRSA.

Keywords

methicillin-resistant *Staphylococcus aureus*; social isolation; psychosocial effects

From leprosy to tuberculosis to human immunodeficiency virus, individuals afflicted by infectious diseases have long perceived stigmatization.^{1–3} Understanding and addressing psychosocial effects is an integral facet of infectious disease treatment and prevention, as concern for judgement and social isolation can inhibit people from seeking treatment.

Methicillin-resistant *Staphylococcus aureus* (MRSA) emerged in the early 1960s and manifests itself in a variety of clinical entities ranging from skin and soft tissue infection (SSTI) to invasive disease (eg, osteomyelitis, pneumonia, and bacteremia).^{4, 5} Within hospitals, the implementation of contact precautions (i.e., wearing a gown and gloves when entering the patient's room) is a recommended intervention to combat MRSA transmission.⁶ Several studies have evaluated patient perspectives regarding the impact of contact precautions on their well-being while hospitalized, noting an inverse association between contact precautions and interactions with hospital staff (e.g., staff enter rooms of patients requiring contact precautions less frequently), as well as patient perceptions of decreased communication with physicians, lack of respect for their needs and preferences, and symptoms of depression and anxiety.^{7–9}

Over the past 2 decades, hyper-virulent strains of MRSA have emerged in community settings, labeled community-associated MRSA (CA-MRSA), affecting otherwise healthy individuals.^{4, 5} Despite CA-MRSA's establishment as a community pathogen, few studies have evaluated its psychosocial impact outside of the hospital setting. Because CA-MRSA infections are known to cluster within households and have a recurrence rate as high as 50% within one year,^{10, 11} the emotional impact of this disease on both the patient and their family members can be extreme. Anecdotal case narratives have highlighted situations in which patients with MRSA infections were no longer allowed to interact physically with other family members or were forced to move into the home's garage or to a different home.¹² It is essential to include impressions of family members and reactions to a patient's MRSA diagnosis in the analysis of psychosocial effects, as the family social unit can dramatically affect a patient's ability to heal.^{13, 14}

The objective of the present mixed-methods study was to better understand the psychosocial effects of a MRSA diagnosis on the households of children with CA-MRSA SSTI. Specifically, we sought to explore changes in health behaviors, effects on relationships and social interactions, both within and outside of the household, and knowledge and awareness expressed by caregivers of children diagnosed with CA-MRSA SSTI.

METHODS

The population for the current study was derived from a larger observational cohort study, “HOME: Household Observation of MRSA in the Environment,” which was conducted between January 2012 and October 2016 and aimed to discern MRSA household transmission dynamics. Recruitment took place at St. Louis Children’s Hospital (SLCH), Cardinal Glennon Children’s Hospital, and eleven community pediatric practices in metropolitan St. Louis affiliated with the Washington University Pediatric and Adolescent Ambulatory Research Consortium (WU PAARC). The HOME study enrolled 150 otherwise healthy pediatric patients with a culture-confirmed CA-MRSA SSTI and their household contacts (defined as individuals sleeping in the home 4 nights per week), followed by 4 consecutive study visits over 1 year. Upon completion of their participation in the HOME study, 105 study families continued in an interventional trial (“HOME2”) consisting of five additional study visits over a period of one year. Between January 2015 and February 2017, 82 HOME2 households were invited to engage in a qualitative interview interrogating the psychosocial effects of MRSA; 76 households agreed to participation. The Washington University Human Research Protection Office and Institutional Animal Care and Use Committee approved study procedures. Informed consent and assent were obtained for all household members and pets.

Data collection

For the HOME observational study, five study visits took place in participants’ homes over the course of 12 months (enrollment, 3, 6, 9, and 12 months). Detailed information regarding medical history, including *S. aureus* infections, activities, and hygiene practices, was collected at the enrollment visit. Culture swabs for detection of *S. aureus* from the household members, pet dogs and cats, and up to 21 household surfaces (from the bedroom, bathroom, kitchen, and living area) were collected by the study team to investigate their potential role in household *S. aureus* transmission, as described previously.¹⁵ Questionnaires were administered at each follow-up study visit to collect information about the development of new SSTIs subsequent to the previous visit. At the 12-month study visit, each household was given a printout of the *S. aureus* colonization results from each culture swab collected over the one-year observational study. Additionally, households were randomized into a decolonization trial (HOME2, [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT01814371) NCT 01814371) at the time of the 12-month visit, followed by 5 longitudinal study visits (13, 15, 18, 21, and 24 months).

At the 13-month study visit, a trained study team member administered a qualitative interview (described below) to the primary caregiver of the index patient. This survey was constructed to gather information regarding the psychosocial effects of having a child with a history of CA-MRSA infection in the household. The survey was administered at the 13-month visit to give families adequate time to process the colonization prevalence results provided to them at the 12-month visit, and to allow them to pose questions regarding these results to the study team. Interviews were audio recorded with the participant’s written consent. All interviews were transcribed and double-checked against the audio recording by a second team member to detect any content errors.

Measures

The principal constructs to be measured in the present study were health behavior changes, disclosure, social interactions, and knowledge/awareness surrounding having a child with CA-MRSA infection. We also aimed to evaluate CA-MRSA's effect on the health and social behaviors of the primary caregiver (i.e., the household member asked to participate in the interview) and the family's psychosocial functioning. Due to the paucity of information regarding family functioning and psychosocial effects in pediatric CA-MRSA diagnoses, we chose to gather information using methods that allowed responses to be probed and otherwise explored (e.g., a survey with open-ended questions).

Survey construction

A 13-question qualitative interview to assess the study participants' perceptions of being socially isolated by others, changes in health and social behaviors, and awareness was constructed. The survey was assembled by the senior author (SF) based on her experience as a clinician working with families afflicted by CA-MRSA infection and the existing literature regarding MRSA and other acquired infections, complemented by a collaborator's methodologic expertise in qualitative research (as there are no available validated instruments). The resulting survey instrument consisted of ten dichotomous (yes/no) questions with a secondary, open-ended probe for elaboration of each answer (e.g., "If yes, in what way?") (Figure 1); an open-ended question regarding the respondent's reaction to the presence or absence of *S. aureus* in their household environment (Figure 2, A); and 2 5-point Likert scale questions, specifically, "How concerned are you about future infections for yourself or your family members?" and "How worried are you about spreading MRSA to other people?" (Figure 2, B). These questions were selected to query how MRSA might have affected the study participants and their families within and outside of their homes (Figure 1).

Statistical and content analyses

Statistical analyses were performed using IBM SPSS v23 (IBM SPSS, Chicago, IL). For the dichotomous questions, univariate analyses were conducted using chi-square tests. P-values of <0.05 were considered significant. Content analyses of the interview transcripts were entered into NVivo software v11 (QSR International Pty Ltd, Victoria, Australia). Analyses involved three types of coding: open, axial, and selective. Open coding involved the development of an extensive list of broad labels, referred to as nodes in NVivo. Axial coding involved a cross-comparison of labels and categories, examining similarities and differences in concepts that emerged within and across households. Lastly, selective coding consisted of a review of the transcripts in NVivo to refine the initial list of codes into final themes based upon the study objectives. The analytical team reviewed the codes at every step to achieve clarity and accuracy, explicate code relevance, and standardize code definitions.

RESULTS

Seventy-six households with a child diagnosed with MRSA SSTI (i.e., index patients) were enrolled. Primary caregivers were 97% female and had a median age of 35 years (range 23-55); many had completed at least some college (85%) (Table I). The majority of index

patients (67%) had a history of SSTI prior to the infection that prompted enrollment in the observational cohort study; 54% percent of index patients also experienced a recurrent SSTI during the longitudinal study period and 74% had at least one household contact, in addition to the index patient, with a history of SSTI prior to study enrollment; of these households, 51% of household contacts experienced at least one SSTI during the longitudinal study. Specifically, 21% of primary caregivers experienced at least one SSTI during the longitudinal study.

Qualitative themes

The qualitative results of this study (taken from the open-ended probes to the dichotomous questions) are presented in accordance with four major themes: health behavior changes, disclosure, social interactions, and knowledge/awareness. A summary of the themes with definitions and exemplar text can be found in Table 2.

Health behavior changes—Caregivers adopted new behaviors in their daily lives in an attempt to prevent future infections. Overall, 42% of survey respondents expressed that their child's MRSA diagnosis caused a change in how household contacts interacted with one another. Forty percent of caregivers stated that they personally treat their child(ren) with a history of MRSA infection differently than their child(ren) who have not experienced MRSA SSTI (Figure 1); specifically, they reported limiting physical contact with the affected child, isolating the child from other children in the household, especially during an active outbreak, and being more vigilant about inspecting their children for potential recurrent infections (Table 2; **Health behavior changes**). Primary caregivers with at least some college education were more likely to think household interactions changed due to the MRSA diagnosis compared with primary caregivers with no college education (48% vs. 9%, $p=0.02$). Additionally, most caregivers changed their hand washing behaviors, specifically adding the use of alcohol-based hand sanitizers as a result of their child having a MRSA infection (Table 2; **Health behavior changes**). Twenty-five households (33%) had a pet from whom *S. aureus* had been recovered from the nose or dorsal fur; only one of these households reported treating the colonized pet differently (e.g., limiting physical contact with the pet's nose and face). Most often, the reason for not treating pets differently was that the pet "won't allow you to – they do what they want."

Behaviors surrounding environmental cleaning practices also changed. An increase in cleaning frequency and the use of bleach products were the most common changes (Table 2; **Health behavior changes**). Although some households implemented drastic forms of cleaning (e.g., cleaning all surfaces of the house with bleach), others perceived that simple changes, such as limiting shared spaces or no longer sharing personal hygiene items, were sufficient (Table 2; **Health behavior changes**). Overall, most households reported adopting more cautious personal hygiene behaviors in addition to changes in their environmental cleaning routines. The majority (91%) of participants shared their child's MRSA diagnosis with people outside of their household. Disclosure was the most dominant theme emerging from our survey, with 90% of households discussing disclosure in relation to the nature of their interactions with other people. Primary caregivers with at least some college education were more likely to disclose their child's diagnosis than those with no college education

(95% vs. 64%, respectively, $p=0.001$). The most common reasons for disclosing the MRSA diagnosis to others (e.g., health care providers, teachers, and coaches) were to help monitor for possible recurrent infection, to educate others and promote awareness within their social network, and to gain support and assistance from family members (Table 2; **Disclosure**). The few caregivers who were reluctant to disclose their child's MRSA diagnosis stated they only told others on a "need to know basis," but they were more willing to disclose to close/immediate family members. Just under half (42%) of caregivers reported that the location of their child's infection was visible to other people (e.g., on their face, arm, leg, etc.), a factor which influenced the likelihood that caregivers would share the MRSA diagnosis ($P = .001$).

Most households did not think that their child's MRSA diagnosis limited activities performed outside the home (62%) (e.g., going to the gym, participating in school activities/sports/social functions) or how they interacted with people outside of their household (66%) (e.g., avoiding physical contact with other people, not going to another person's home, or not sitting near another person) (Figure 1). Moreover, primary caregivers with a diagnosed mood disorder were less likely to alter their interactions with people outside of the household compared with primary caregivers without a diagnosed mood disorder (6% vs. 42%, respectively, $p=0.008$). Of the 38% of households that reported changing their interactions, most did not want to expose vulnerable individuals, including infants or older adults, to MRSA (Table 2; **Social interactions**). Although most households did not initiate changes in their interactions with others outside the household, many participants reported feeling isolated and ostracized by family and friends because of the MRSA diagnosis. For example, one family shared, "My family treated us like we had the plague for three months...not wanting to come around.... They would not come to my house. In fact, I was supposed to go with my sister to a wedding and she asked me not to go" (Table 2; **Social interactions**). Other participants shared that they perceived being treated cautiously by daycares and school institutions (Table 2; **Social interactions**). Caucasian primary caregivers were nearly three times more likely to perceive being treated differently upon disclosing their child's MRSA diagnosis than African American or biracial primary caregivers (29% vs 10%, respectively, $p=0.07$), a finding which trended toward significance.

In 73 of the 76 households (96%), *S. aureus* was recovered from at least one household environmental surface. The three most frequent reactions when finding out that *S. aureus* was living on the participants' household surfaces were "surprised" (26%), "not surprised" (18%), and "disgusted" (13%) (Figure 2, A). Within the households that did not show surprise or concern about their results, the most common explanation was because they had deduced that MRSA is everywhere; therefore, they were not inclined to change their behaviors radically (Table 2; **Knowledge**). Neither the level of education of the primary caregiver nor the bioburden of *S. aureus* recovery (i.e., the proportion of colonized surfaces) was found to be associated with a specific reaction to finding *S. aureus* on household surface(s). Of the three households where *S. aureus* was not recovered, 2 respondents were "surprised" *S. aureus* was not recovered, and one was "not surprised."

Several caregivers reported that incomplete knowledge regarding MRSA resulted in angst (Table 2; **Knowledge**). When asked how worried the primary caregiver was about spreading MRSA to other people, 37% said they were "not worried at all," and 5% said they were

“extremely worried” (Figure 2, B). When asked how concerned the primary caregiver was about future infections, 26% said they were “extremely concerned,” and 9% were “not at all concerned” (Figure 2, B). No associations were found between prior history of SSTI in the index patient or household contacts and an increased concern about spreading MRSA to other individuals or experiencing future infections. Additionally, the number of recurrent infections within the household during the longitudinal study period was not associated with either increased concern about future infections or worry about spreading MRSA to other people.

DISCUSSION

Discrimination, fear, and isolation attached to a diagnosis of MRSA may have negative effects on the psychosocial wellness of patients, their caregivers and their family members.^{14,16} Our broad investigation examined the psychosocial impact of a MRSA diagnosis within households of children with CA-MRSA SSTIs in the community setting. In the present study, 38% of participants reported limiting their activities and interactions with people outside of the home because of their MRSA history. Some participants attributed this to negative feelings expressed by others in their interviews with us, and other participants indicated that it was self-imposed by their own desire to isolate themselves out of fear they would spread MRSA. There were also reports that unaffected household contacts of a child with a history of MRSA infection were approached with caution by institutions and individuals outside of their household. In fact, some caregivers said that they were asked by childcare providers to provide documentation assuring that the sibling(s) of the index patient was not infectious despite their own lack of MRSA history. In a few cases, a letter from a physician accompanied by medical literature did not suffice and families had to search for new childcare options. Thus, the social burden of MRSA infections persists after the infection has resolved.

The findings in the present study correlate with studies conducted in hospital settings, examining the emotional impact and psychosocial repercussions of a MRSA diagnosis. A study conducted in Baltimore, MD, explored the knowledge, awareness, and attitudes of 100 caregivers of hospitalized children with a history of MRSA colonization or infection; 51% were worried about spreading MRSA to other people. Moreover, caregivers with a perceived incomplete knowledge about MRSA as well as those with children with a newly identified positive MRSA status reported worry and anxiety about their child.¹⁴ Anxiety resulting from such perception of incomplete knowledge regarding MRSA was also revealed during the present study, which highlights an opportunity for clinicians to provide education regarding MRSA acquisition, transmission, and prevention, thus empowering patients and caregivers. In another study conducted in 2009, 13 Swedish adults with MRSA colonization were interviewed to explore their experiences and understanding of their MRSA status. In addition to feelings of guilt and shame, many participants reported experiencing limitations in their day-to-day lives because they feared spreading MRSA to other people. Furthermore, those interviewed said that they feared isolation and negative judgment from other people if their colonization status was shared.¹⁷ These perceptions are concerning given that social networks are important for overall health and have been associated with decreased rates of hospital readmissions.¹⁶

Within the hospital setting, contact precaution policies, instituted to prevent the transmission of antibiotic-resistant organisms, can incite feelings of isolation and discrimination. Contact precautions include confining patients to their hospital room and requiring healthcare workers to don gowns and gloves when entering the patient's room. These practices, although shown to help reduce the risk of transmission, also have been shown to reduce patient and healthcare worker interaction, resulting in feelings of isolation and anxiety.⁷⁻⁹ The Centers for Disease Control and Prevention recognize these potential adverse outcomes and recommend that hospitals in which patients are placed in contact precautions take measure to "counteract possible adverse effect on patient anxiety, depression, and other mood disturbances; perceptions of stigma; reduced contact with clinical staff; and increases in preventable adverse events."¹⁸ As evidenced by the present study, clinicians in community settings also need to be cognizant of the feelings of isolation associated with a MRSA diagnosis when counseling their patients. Additionally, consideration of the education level and medical history of the primary caregiver, particularly the presence of a mood disorder, could better inform clinicians how to counsel individual families about the potential psychosocial impact of MRSA and provide guidance regarding behavior changes, disclosure, and self-isolation. Community educational campaigns in addition to other strategies may alleviate the negative associations and fears experienced by children diagnosed with CA-MRSA and their household contacts.

Fear of isolation, negative judgments, and other repercussions from disclosing MRSA status not only seem to influence clinical and social interactions but also have implications for family and child development. Early work defining social isolation among children identified frequency and type of interactions with peers and family as critical indicators of isolation.¹⁹ Results from the present study suggest that MRSA-infected children often are subjected to controlled or limited interactions with peers and family. These constraints may have serious developmental and psychological consequences for the child and their family. Furthermore, this study revealed that the family unit might negotiate its social and family interactions based on fear of judgment and spreading MRSA. These fears could potentially act as a stressor on family members and the household atmosphere. Understanding the developmental impact and potential psychological outcomes of a MRSA diagnosis on the family unit is critical.

Several limitations of this study should be considered when interpreting the results. As this is a new field of study, a validated instrument to measure outcomes of interest was not available, and thus, the interview administered was created *de novo* by the principal investigator based on clinical experience and existing literature. As the survey respondents had participated in a yearlong study of MRSA within the household, we were unable to fully assess the degree of their MRSA knowledge prior to study participation. Additionally, the prior research relationship between the participants and some members of the research team (excluding the principal investigator) may have introduced social desirability response bias; the principal investigator and study personnel played no role in the patients' clinical care, which minimized the likelihood of bias. The study households were mostly Caucasian or African American, with few of Latino or Hispanic background, living in a single metropolitan area, receiving private healthcare insurance, and with most primary caretakers having some college education. These factors limit the ability to generalize our findings to

other populations. Strengths of our study include a focus on the psychosocial effects of a MRSA diagnosis within the household and community setting. Furthermore, multiple team members independently reviewed the survey transcripts and categorized the answers into the overarching themes to reach consensus in an effort to reduce bias.

As a MRSA diagnosis has negative psychosocial impact, we need to understand how to ameliorate these concerns and burdens so that clinicians can be equipped with educational resources to provide more effective care and treatment plans for patients and their social networks. The findings of our study highlight a need for interventions to combat the negative psychosocial repercussions of a MRSA diagnosis in the community. These essential interventions will inform guidelines for clinicians to best counsel patients and their caregivers about these effects.

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ABBREVIATIONS

CA-MRSA community associated-methicillin-resistant *Staphylococcus aureus*

SSTI skin and soft tissue infection

References

1. Murray EJ, Bond VA, Marais BJ, Godfrey-Faussett P, Ayles HM, Beyers N. High levels of vulnerability and anticipated stigma reduce the impetus for tuberculosis diagnosis in Cape Town, South Africa. *Health Policy Plan*. 2013; 28:410–8. [PubMed: 22945548]
2. Nattabi B, Li J, Thompson SC, Orach CG, Earnest J. Factors associated with perceived stigma among people living with HIV/AIDS in post-conflict northern Uganda. *AIDS Educ Prev*. 2011; 23:193–205. [PubMed: 21696239]
3. Kaehler N, Adhikari B, Raut S, Marahatta SB, Chapman RS. Perceived stigma towards leprosy among community members living close to Nonsomboon Leprosy Colony in Thailand. *PLoS One*. 2015; 10:e0129086. [PubMed: 26047512]
4. Kaplan SL. Community-acquired methicillin-resistant *Staphylococcus aureus* infections in children. *Semin Pediatr Infect Dis*. 2006; 17:113–9. [PubMed: 16934705]
5. Herold BC, Immergluck LC, Maranan MC, Lauderdale DS, Gaskin RE, Boyle-Vavra S, et al. Community-acquired methicillin-resistant *Staphylococcus aureus* in children with no identified predisposing risk. *JAMA*. 1998; 279:593–8. [PubMed: 9486753]
6. Siegel JD, Rhinehart E, Jackson M, Chiarello L. Management of multidrug-resistant organisms in health care settings, 2006. *Am J Infect Control*. 2007; 35:S165–S93. [PubMed: 18068814]
7. Mehrotra P, Croft L, Day HR, Perencevich EN, Pineles L, Harris AD, et al. Effects of contact precautions on patient perception of care and satisfaction: a prospective cohort study. *Infect Control Hosp Epidemiol*. 2013; 34:1087–93. [PubMed: 24018926]
8. Vinski J, Bertin M, Sun Z, Gordon SM, Bokar D, Merlino J, et al. Impact of isolation on hospital consumer assessment of healthcare providers and systems scores: is isolation isolating? *Infect Control Hosp Epidemiol*. 2012; 33:513–6. [PubMed: 22476279]

9. Morgan DJ, Diekema DJ, Sepkowitz K, Perencevich EN. Adverse outcomes associated with Contact Precautions: a review of the literature. *Am J Infect Control*. 2009; 37:85–93. [PubMed: 19249637]
10. Fritz SA, Hogan PG, Hayek G, Eisenstein KA, Rodriguez M, Epplin EK, et al. Household versus individual approaches to eradication of community-associated *Staphylococcus aureus* in children: a randomized trial. *Clin Infect Dis*. 2012; 54:743–51. [PubMed: 22198793]
11. Fritz SA, Hogan PG, Hayek G, Eisenstein KA, Rodriguez M, Krauss M, et al. *Staphylococcus aureus* colonization in children with community-associated *Staphylococcus aureus* skin infections and their household contacts. *Arch Pediatr Adolesc Med*. 2012; 166:551–7. [PubMed: 22665030]
12. Mozzillo KL, Ortiz N, Miller LG. Patients with methicillin-resistant *Staphylococcus aureus* infection: twenty-first century lepers. *J Hosp Infect*. 2010; 75:132–4. [PubMed: 20236730]
13. Reblin M, Uchino BN. Social and emotional support and its implication for health. *Curr Opin Psychiatry*. 2008; 21:201–5. [PubMed: 18332671]
14. Sengupta A, Rand C, Perl TM, Milstone AM. Knowledge, awareness, and attitudes regarding methicillin-resistant *Staphylococcus aureus* among caregivers of hospitalized children. *J Pediatr*. 2011; 158:416–21. [PubMed: 20961568]
15. Fritz SA, Hogan PG, Singh LN, Thompson RM, Wallace MA, Whitney K, et al. Contamination of environmental surfaces with *Staphylococcus aureus* in households with children infected with methicillin-resistant *S aureus*. *JAMA Pediatr*. 2014; 168:1030–8. [PubMed: 25200331]
16. Rodriguez-Artalejo F, Guallar-Castillon P, Herrera MC, Otero CM, Chiva MO, Ochoa CC, et al. Social network as a predictor of hospital readmission and mortality among older patients with heart failure. *J Card Fail*. 2006; 12:621–7. [PubMed: 17045181]
17. Lindberg M, Carlsson M, Hogman M, Skytt B. Suffering from methicillin-resistant *Staphylococcus aureus*: experiences and understandings of colonisation. *J Hosp Infect*. 2009; 73:271–7. [PubMed: 19783322]
18. Siegel JD, Rhinehart E, Jackson M, Chiarello L, the Healthcare Infection Control Practices Advisory Committee. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Centers for Disease Control and Prevention; 2007. Available from: <https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines.pdf>
19. Gottman J, Gonso J, Schuler P. Teaching social skills to isolated children. *J Abnorm Child Psychol*. 1976; 4:179–97. [PubMed: 780399]

Figure 1. Effects of MRSA on household contacts and pets

The above figure displays the survey questions answered by study participants. N denotes the number of responses. The bar graph on the right indicates the percent of 'yes' and 'no' responses.

Figure 2. Concern and worry about MRSA recurrence and spread

A. The above figure shows the answer responses to the open-ended question asked to study participants and the percent of responses. The responses presented in quotation marks denote exact quotes pulled from the interview transcripts of study participants. **B.** The above figure displays the Likert Scale answer options to two survey questions posed to study participants and the percent of responses.

Table 1**Participant and Household Characteristics**

Characteristic	N = 76 (%)
Age of index patient ^a , years, median (range)	4 (1-17)
Sex of index patient ^a	
Male	35 (46)
Female	41 (54)
Age of primary caregiver ^b , years, median (range)	35 (23-55)
Sex of primary caregiver ^b	
Male	2 (3)
Female	74 (97)
Latino/Hispanic ethnicity ^{c,d}	
Yes	5 (7)
No	71 (93)
Race ^{c,d}	
Caucasian	55 (72)
African American	17 (22)
Multiracial ^e	4 (5)
Health insurance status ^d	
Private	58 (76)
Medicaid/State sponsored	15 (20)
Tricare/Veterans Administration	2 (3)
None	1 (1)
Highest level of education of primary caregiver ^b	
Some high school	2 (3)
High school diploma/GED	9 (12)
Some college	21 (28)
College degree	30 (39)
Graduate degree	14 (18)
Mood disorder in primary caregiver ^b	16 (21)
Individuals per household, median (range)	4 (2-13)
<i>S. aureus</i> infection and/or SSTI in index patient ^a prior to enrollment ^f	51 (67)
<i>S. aureus</i> infection and/or SSTI in primary caregiver ^b prior to enrollment ^f	24 (32)
<i>S. aureus</i> infection and/or SSTI in any household contact ^g prior to enrollment ^f	56 (74)
SSTI in index patient ^a during the longitudinal study period	41 (54)
Number of SSTIs during longitudinal study period, median (range) ^h	2 (1-5)
SSTI in primary caregiver ^b during the longitudinal study period	16 (21)

Characteristic	N = 76 (%)
Number of SSTIs during longitudinal study period, median (range) ^h	1 (1-2)
SSTI in household contact ^g during the longitudinal study period	39 (51)
Number of SSTIs during longitudinal study period, median (range) ^h	2 (1-4)

NOTE: GED, general education development; SSTI, skin and soft tissue infection

^a Index patient is the child with the culture-confirmed MRSA SSTI prompting study enrollment

^b The household member participating in the interview

^c Race and ethnicity were self-reported

^d At the household level

^e Multiracial participants were African American and Caucasian

^f This does not include the infection which prompted enrollment into the study

^g Individuals sleeping in the index patient's home 4 nights per week, excluding index patient

^h Of those with at least 1 SSTI

Table 2

Coding summary: themes, definitions, subthemes, exemplar texts

Theme	Definition	Subtheme	Exemplar text
Health behavior changes	Preventative health behaviors and description of health behavior changes in response to MRSA diagnosis within the household unit.	Hand washing	<i>I'm more conscious of making sure my hands are washed when I'm touching the kids, you know, when they're sick and stuff. I am cautious of what they touch and I take hand sanitizer... with me.</i>
		More vigilance	<i>I think the only thing it could have changed would be possibly the way that we look at the kids and when they have a skin abrasion or cut or something on their body.</i>
		Cleaning changes	<i>My reaction was a deep cleaning of... our entire house. I scrubbed. I disinfected. I cleaned like nobody's business. I think at the beginning it did [change our behaviors], but now that we know that it's kind of everywhere, I don't think it does anymore.</i>
		Sharing reduction	<i>I change a hand towel at least once during the day, if not twice, and then they only bathe with their own towel, and before it was kind of a free-for-all. We are more conscientious about sharing things such as deodorant. We used to share deodorant before... we don't do that anymore. We don't share towels. I think we are much more conscientious about that kind of stuff. There is a greater emphasis in maintaining a little personal space... "Please don't share that." "Let's wipe that off." "Get your own towel." "No, don't use that washcloth." There's a lot more attention paid to not sharing things.</i>
Disclosure	Decision and rationale for sharing the MRSA diagnosis with individuals outside of the household	Diligence	<i>Because they need to be diligent about it and to understand what it is and what's going on and how easily, you know, it can be transferred from one person to the next.</i>
		Education	<i>I wanted to make sure that they [other parents] were aware that this could happen. And like, other people with MRSA, I wanted them to know that I understood what they were going through. Her mother, my mother, immediate family... People that would potentially watch her or spend time with her... just to make sure they, you know, make sure they paying more attention to her too when she's with them.</i>
Social interactions	Notable changes to physical and social behaviors with others in response to the MRSA diagnosis	Self-isolation	<i>I'm self-conscious about spreading it around and to other people... I don't want to have that on my conscience since how badly it's been sometimes, I don't want anybody else to have to go through that. I limit who he has contact with because I don't want him to spread it [MRSA] to other kids or babies or anyone like that. There have been things that we've not gone to or we have cancelled because either they are sick or like my grandparents are really frail. So it's like we were afraid for the first few months to take him over there because we didn't want him to infect or them get infected because of exposure or whatever. I don't hug everybody like I used to you know... If you go to the restroom, after you wash your hands, I take a tissue to touch the door to go out, because it's kind of defeating the purpose to wash your hands and still touch that door. Same way at work, I just try to be more cautious with hand sanitizers. [During an MRSA SSTI episode] we would, um, we had to excuse ourselves from our obligations for like six weeks... So play groups, nursery groups.</i>
		Isolated by others	<i>We have that one friend of ours who was completely disgusted by the fact that we had had that [MRSA infection]. And I do think they're a little different now, especially since they have a little one. I think they definitely feel on edge when they're here or around us. My family treated us like we had the plague for three months... not wanting to come around.... They would not come to my house. In fact, I was supposed to go with my sister to a wedding and she asked me not to go.</i>

Theme	Definition	Subtheme	Exemplar text
			<p><i>My father who visits now, just never takes a shower at our house... He's here for three days. He says, "I don't sweat that much." Then he's gone. But he never takes a shower here.</i></p> <p><i>When my friend had her baby... she didn't want me to come to the hospital when he was a newborn.</i></p> <p><i>The daycare was concerned. I literally had to bring letters to show he was safe with having bandages on him and that he wasn't spreading it to anyone else.</i></p> <p><i>If she [sibling of index patient] had any cuts or anything like that, they [the daycare] wanted her covered over with Band-Aids. She didn't have it [MRSA] and she's never had it. She's fine.</i></p> <p><i>Understand he's [index patient] got it but she doesn't.</i></p> <p><i>Well we were talking about wrestling... It [MRSA] took him off for a whole year. Um, it limited—he had a couple outbreaks during warm weather—he couldn't go swimming and do other things like that.</i></p>
Knowledge	Information acquisition and dissemination about MRSA infection	Knowledge	<p><i>Of course I freaked out, you know. You know, you freak out, you try to become diligent in combatting it and, you know, educating other people as well, so.</i></p> <p><i>Well, because I was not educated I was very upset. I was like oh my gosh. We have this disease and no one is going to like us. We are going to be alienated. We are going to be outcasts. Then I got educated and started educating people. My family, I started educating them.</i></p>
Awareness	Apprised of MRSA on the household surface	Awareness	<p><i>I was a little bummed... concerned... especially when you think you're cleaning appropriately and maybe you could have done something to prevent it, maybe you couldn't have, but wipe the surface down, even whether it be with bleach or whatever, and you think "ok, I'm good." But you might not be.</i></p>