

Methicillin-resistant *Staphylococcus aureus*

Management of asymptomatic colonization and outbreaks of infection in long-term care

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Asymptomatic colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) is common in long-term care facilities, but the burden of symptomatic infection appears to be low. Patients known to be MRSA carriers should not be refused admission, and routine cultures to identify carriers are not warranted. In the absence of symptomatic MRSA, no measures beyond routine infection control and standard precautions are necessary. Increased rates of infection should prompt investigation of a potential outbreak and initiation of more drastic infection-control measures. During an outbreak, both infected and colonized residents should be isolated until transmission has been halted. Using short-term nasal application of mupirocin ointment for MRSA-colonized residents and staff implicated in the outbreak may help break the chain of transmission.

McNeil SA, Mody L, Bradley SF. Methicillin-resistant *Staphylococcus aureus*: Management of asymptomatic colonization and outbreaks of infection in long-term care. *Geriatrics* 2002; 57(June):16-27.

S*ta**ph**yl**oc**oc**c**u**s* *aureus* is an important cause of infection-related morbidity and mortality in older patients in acute-care hospitals or residing in long-term care facilities (LTCFs). This pathogen is the second most common cause of nosocomial bacteremia, pneumonia, and soft-tis-

sue infections among hospitalized older adults.¹ Older patients infected with *S aureus* are twice as likely to die as younger patients with similar infections.¹

Clinical isolates of methicillin-resistant *S aureus* (MRSA) were recognized in the United States as early as 1960, and the first documented outbreak of MRSA infection occurred at Boston City Hospital in 1968.² Since then, MRSA—with its intrinsic resistance to methicillin, nafcillin, oxacillin, imipenem, cephalosporins, and other antimicrobial agents—has become an increasingly important cause of nosocomial infection in acute care hospitals.

Only recently has the magnitude of asymptomatic colonization and symptomatic infection with MRSA in older patients living in LTCFs been recognized and explored. In this article, we discuss the characteristics and trans-

mission of MRSA in LTCFs and describe the measures that are necessary and reasonable to control the introduction and spread of this pathogenic organism.

Should we worry?

Approximately 2.5 million Americans reside in LTCFs, and more than 1 million who turned 65 in 1990 are expected to live in a LTCF at least once before they die.³ The number of nursing homes in the United States reporting asymptomatic colonization or infection of residents with MRSA has been steadily increasing since the first reported outbreaks in LTCFs in the late 1980s.⁴⁻⁶ Rates of colonization vary widely by:

- geographic location
- facility size
- prevalence of MRSA in referring acute-care institutions
- severity of illness of the patient population
- and institutional infection-control practices.

Most studies suggest that MRSA colonization and infection are becoming a major concern for many LTCFs. In fact, surveillance studies in community and Veterans Affairs (VA)-associated LTCFs have documented asymptomatic MRSA colonization of the anterior nares, skin, wounds, or rectum in 6 to 34% of residents.^{4,7-13} VA-associated LTCFs (which generally care for younger, sicker, predominately male patients) are overrepresented among

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studies on MRSA prevalence, when compared with community nursing homes. Generally, VA facilities have much higher MRSA prevalence rates than free-standing community-based LTCFs.

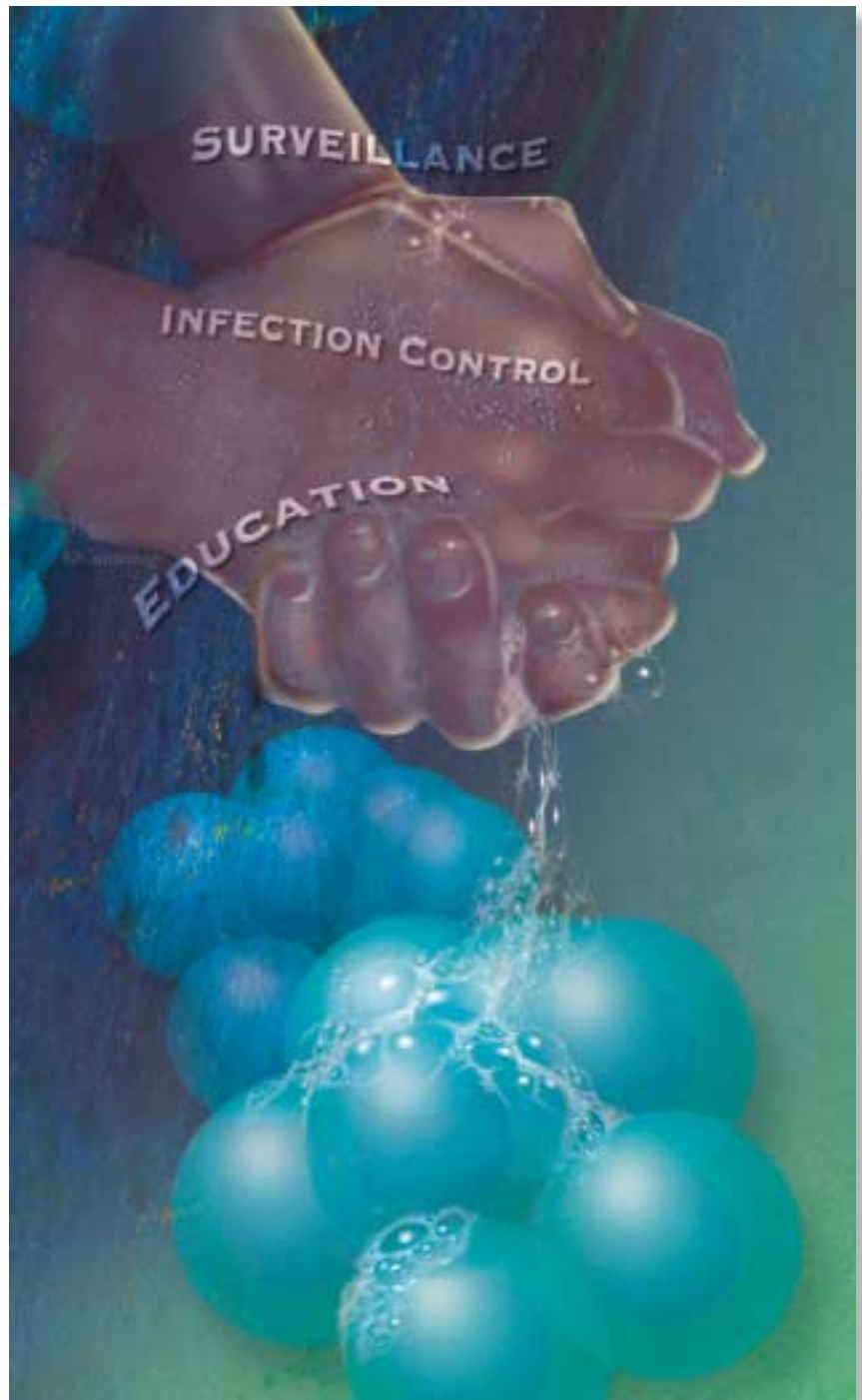
Not all patients in a LTCF will acquire MRSA colonization, even in facilities in which the organism is endemic. An epidemiologic study of one such facility found that 65% of residents never acquired MRSA during an average length of stay of 3 months.⁷ The same study showed that only 10% of colonized residents acquired MRSA during their stays.

Five factors that have been shown to increase a patient's risk of colonization following exposure to MRSA are listed in table 1.^{7-9,14} There is little evidence showing that increased age alone is a risk factor for MRSA colonization. Although one study found that patients colonized with MRSA were significantly older than those colonized with methicillin-susceptible *S aureus* (MSSA) or not colonized at all,¹⁵ this has not been the case in other studies.^{8,14}

In addition to its occurrence in older patients with recognized risk factors, MRSA colonization also occurs more frequently in patients who are debilitated, suggesting that it may be a marker for increased severity of illness from all causes. Residents of LTCFs who are colonized with MRSA are more likely to develop any infection and more likely to die from any cause than patients colonized with MSSA.⁸ Once colonized, older patients often carry the same strain of MRSA for 3 months to 3 years.⁷

Infection with MRSA

Although it commonly causes only asymptomatic colonization, *S aureus* is a highly pathogenic organism with the propensity to cause serious, deep-seated infections and to disseminate to multiple body sites (figures 1 and 2). A common cause of blood-stream infections, pneumonia, endocarditis, skin and soft tissue infections, and bone and joint infections, *S aureus* in-



Asymptomatic colonization with MRSA is common in long-term care facilities, but the burden of symptomatic infection appears to be low. Hand washing is the most important measure for controlling the spread of MRSA.

Illustration for Geriatrics by Sally Cummings

fection is often associated with significant morbidity and mortality.

Initially, MRSA was felt to be more virulent than its antibiotic-susceptible predecessor.² Many healthcare workers in acute and LTCFs still assume that this is true, perhaps because of special

infection-control measures often implemented to prevent the spread of MRSA. In case control studies, however, no clear difference is seen in types of infections, infection severity, and infection-associated mortality caused by MRSA and MSSA.² Animal models

Table 1 Factors shown to increase risk of MRSA colonization in a patient residing in long-term care

Prior hospitalization

Recent use of a broad-spectrum antimicrobial

Impaired functional status

Use of medical devices such as a urinary catheter, nasogastric feeding tube, or IV catheter

Chronic diseases leading to wounds or skin breakdown

MRSA: Methicillin-resistant *Staphylococcus aureus*

Source: Prepared for Geriatrics by Shelly A. McNeil, MD, Lona Mody, MD, and Suzanne F. Bradley, MD, from references 7-9 and 14.

and in vitro studies of *S aureus* infection demonstrate similar virulence properties in MRSA and MSSA.²

Although not more virulent than MSSA, MRSA infections are significantly more difficult and costly to treat. Treatment of MRSA infection generally requires IV antibiotics that are associated with more adverse events than oral antibiotics and often necessitate transfer of the patient to an acute-care hospital. The resultant increased morbidity, mortality, and cost justify attempts to prevent the introduction of MRSA into a LTCF or to control its spread once it has become endemic.

Asymptomatic colonization with MRSA is an important risk factor for development of MRSA infection.⁸ Although in some studies MRSA-colonized residents of LTCFs were more likely to develop MRSA infection than noncolonized residents,⁸ other studies have shown low infection rates despite high prevalence of MRSA colonization.⁷ In contrast to acute-care hospitals, where 30 to 60% of colonized patients will develop a nosocomial MRSA infection, only 5 to 15% of colonized residents in LTCFs will develop infection, and 5% of deaths in LTCFs are caused by MRSA.^{7,8}

Comorbidity and overall severity of illness appear to be more important predictors of MRSA infection than age alone among those who are colonized. The presence of diabetes mellitus or peripheral vascular disease has been shown to increase the risk of MRSA

infection in patients who are colonized.¹⁶ MRSA infection also may result from invasive interventions, such as surgical procedures and dialysis.

What can be done?

Much debate has surrounded the role of the older nursing home patient in the epidemiology of MRSA. Investigation of several early MRSA outbreaks in acute-care hospitals in the United States implicated patients who were believed to have acquired MRSA in a nursing home. This fostered the speculation that LTCFs serve as a reservoir for the organism and their residents as vehicles for transmission of MRSA into the acute-care setting.^{2,5,17,18}

On the other hand, introduction of MRSA from the acute care setting into LTCF has been well documented.^{4,7,10} In studies that have attempted to identify where older residents acquired MRSA colonization, up to 25% have been found to be colonized upon transfer to the LTCF from an acute-care hospital.^{7,11}

Concerns over the potential for introduction of MRSA into LTCFs from the acute-care setting have prompted many nursing homes to institute policies that prohibit admission of patients known to be colonized with MRSA. To identify these patients on arrival, some LTCFs have instituted universal screening of patients felt to be high-risk for colonization. Residents found to be colonized after admission may be cohorted (placed) with other colonized

patients or placed under strict contact isolation precautions similar to those used in the acute-care setting.

Although perhaps justifiable in the acute-care setting, these measures may impose undue hardship on both the staff and residents of LTCFs. Unlike hospitalized patients, residents of LTCFs often reside in the facility long-term for rehabilitation or may live in the LTCF permanently. Infection-control policies that restrict the movement of colonized residents reduce their quality of life and make rehabilitation efforts difficult. Policies that require the routine use of gowns and gloves by healthcare personnel are costly and time-consuming and may adversely affect care in LTCFs in which nurse/resident ratios are low and nursing time is at a premium.

Transmission. Decisions regarding the intensiveness of infection control for MRSA in LTCFs require understanding of both the frequency and mechanisms of transmission of the organism within these facilities as well as the impact that this transmission has on the health of its residents and staff. Although MRSA colonization rates within a LTCF are generally not known, studies suggest that they may be high.

How often do colonized residents pass the organism along to other residents? In a prospective study designed to examine MRSA transmission in a LTCF, Bradley et al found that only 35 of 341 (10%) MRSA-colonized residents of a VA-associated LTCF acquired MRSA in the LTCF.⁷ Of these 35 patients, only 9 (26%) became colonized with the same strain isolated from a roommate. Thus, over a 1-year period, only 3% of patients at risk for acquiring MRSA from a colonized roommate became colonized.

Of those patients who acquired MRSA from their roommates, all had some limitation of their functional status and required at least moderate assistance with activities of daily living. None of the patients who acquired MRSA in the LTCF developed infection with MRSA. These data and those

of Hsu suggest that resident-to-resident transmission of MRSA in LTCFs may be uncommon^{7,9} and support the observations of Muder et al that acquisition of MRSA in this patient population may have less impact on morbidity and mortality than in acute-care hospitals.⁸

Other factors. Understanding the role of healthcare workers and the environment in the transmission of MRSA within a LTCF is also critical to the development of infection control policy. Health care workers represent an important source of transmission of MRSA. During outbreaks (ie, an increase in the rate of MRSA infection above the normal rate for the facility), rates of MRSA colonization among healthcare workers may range between 3 and 37%. Transmission of MRSA from the hands of transiently colonized healthcare workers to patients is felt to be the primary mode of spread for MRSA in both acute-care hospitals and LTCFs. Asymptomatic, persistently colonized healthcare workers have been implicated in several MRSA outbreaks.¹⁷

The environment (ie, living space, usually the patient's room and the items in it) has been noted to be an uncommon source for transmission of MRSA among LTCF residents. In one study, only 9% of 380 environmental cultures for MRSA were positive.⁷ Although 39% of patient rooms yielded MRSA, only 3 of 15 patients who were exposed to those rooms became colonized with the same strain. Colonization of common areas used by patients and staff was very uncommon. These data suggest that environmental contamination probably plays very little role in the dissemination of MRSA in a LTCF.

Routine control measures

What control measures are necessary and reasonable to prevent the introduction and spread of MRSA in LTCFs? Although this issue is controversial, it seems inappropriate to simply extend the often-extensive infection control measures implemented in the acute-care setting into the LTC set-

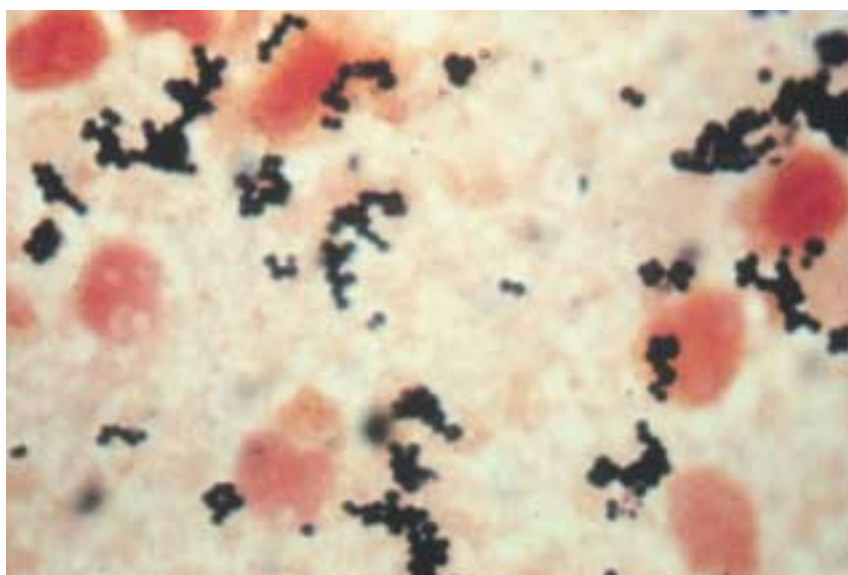


Figure 1. Gram stain (1,000 \times) of sputum obtained from a patient with MRSA pneumonia. Numerous gram positive cocci in clusters and numerous neutrophils are evident.

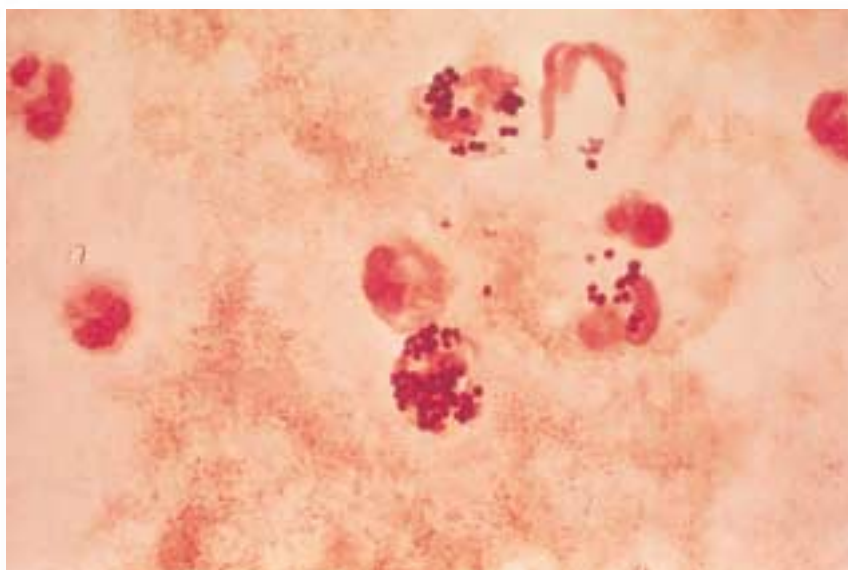


Figure 2. Gram stain (1,000 \times) of pus from a patient with a wound infection due to MRSA. Numerous gram positive cocci in clusters and numerous neutrophils are evident.

Photography courtesy of Suzanne F. Bradley, MD

ting unless MRSA infection is clearly documented as a problem.

Few LTCFs have the laboratory facilities or infection-control personnel necessary for routine screening for MRSA colonization nor the financial or bed resources necessary to maintain strict contact isolation of colonized residents (which requires admission to a private room and routine use of

gowns and gloves by all personnel entering the room). Guidelines that are tailored to MRSA control in the LTCF are needed given the differences in patient populations, types and goals of care provided, and infection control resources between LTCFs and acute-care hospitals (table 2).

In 1994, the MRSA Task Force of the American Hospital Association pub-

Table 2 Routine measures to control MRSA in the long-term care facility**Recommended**

Develop an individualized infection control strategy, based on antimicrobial resistance and available resources

Educate personnel to use standard precautions for the care of all patients

Follow routine, standardized housekeeping practices

Enforce handwashing and use of gloves when exposure to body fluids or nonintact skin is likely and gowns when soiling of healthcare workers' clothing is possible

Implement a procedure for routine surveillance for MRSA outbreaks

Not recommended

Refuse admission to patients known to be infected or colonized with MRSA

Require routine screening of patients for MRSA prior to transfer to a long-term care facility

Obtain surveillance cultures to identify MRSA carriers

Attempt decolonization of asymptotically colonized residents or healthcare personnel, unless they have been implicated in transmission of infection

Restrict residents known to be colonized with MRSA from common areas or from participation in group activities, as long as appropriate wound care and secretion control is maintained

MRSA: Methicillin-resistant *Staphylococcus aureus*

Source: Prepared for Geriatrics by Shelly A. McNeil, MD, Lona Mody, MD, and Suzanne F. Bradley, MD, from references 6, 19, and 20.

lished recommendations for the control of MRSA in acute-care hospitals and LTCFs.¹⁹ This document stressed the need for each individual facility to develop an MRSA control plan based upon:

- prevalence of MRSA in the facility and in referring acute-care institutions
- frequency of MRSA transmission and burden of risk factors in the institution's patient population
- availability of resources.

The Society for Healthcare Epidemiology of America position paper on antimicrobial resistance in LTCFs also highlights the need for individualization of infection control strategies based upon a facility's local situation.⁶ There is agreement on several principles of MRSA control in LTCFs:

- Patients known to be infected or colonized with MRSA should not be refused admission.^{6,19,20} This practice leads to poor use of resources in acute-care facilities and has not been shown to be effective in stopping the spread of MRSA between hospitals and LTCFs.⁶

- If a patient's MRSA status is known, the transferring facility should notify the receiving institution so that appropriate infection-control precautions can be followed. However, pa-

tients should not be routinely screened for MRSA prior to transfer to a LTCF. This costly measure has not been shown to be an effective part of MRSA control.

Routine infection-control strategies for the control of MRSA infection in LTCFs in the absence of epidemic infection rarely require measures beyond standard precautions recommended for the care of all patients. Emphasis should be on hand washing and the use of gloves when exposure to body fluids or nonintact skin is likely, and on the use of gowns when soiling of healthcare workers' clothing is possible.

Hand washing. Hand washing is the most important measure for controlling MRSA. It has been shown to remove MRSA from the hands of healthcare workers who acquired it during the care of colonized or infected residents. Ongoing staff education regarding proper techniques, indications, and importance of hand washing is a cost-effective means of reducing MRSA transmission in LTCFs.

Education. Education of personnel should be ongoing to minimize risk factors in LTCF residents, such as development of pressure, vascular, and diabetic ulcers and use of invasive devices such as urinary catheters and feeding tubes.^{6,20} The use by person-

nel of appropriate barrier precautions during the care of wounds and invasive devices for all patients is recommended.^{6,20}

Housekeeping. Given evidence that environmental contamination plays little, if any, role in the transmission of MRSA in LTCFs, no special housekeeping measures need be implemented. For this organism, routine, standardized housekeeping practices are sufficient in the long-term care setting.

Surveillance. Infection control surveillance is critical in LTCFs. Routine surveillance for MRSA encompasses:

- regular review of available microbiological data obtained for clinical purposes
- maintenance of a list of patients known to be asymptotically colonized or infected with MRSA (according to standard definitions of colonization and infection)
- and identification of threshold MRSA infection rates that will prompt initiation of more aggressive infection-control measures.⁶

Surveillance cultures to identify MRSA carriers are not warranted. In the absence of an outbreak or of documented cross-infection or cross-colonization, residents known to be colonized with MRSA should not be restricted from common areas or from

Table 3 Recommended infection control measures during an outbreak of MRSA infection in a long-term care facility

- Implement established protocol when infection control surveillance identifies a higher-than-baseline rate of MRSA infection within the long-term care facility
- Isolate or cohort patients with symptomatic MRSA infection
- Screen staff and other residents who have had contact with infected cases
- Isolate only those asymptomatically colonized with MRSA linked to infection cases
- Remove from duty colonized healthcare workers who have been implicated in the transmission of MRSA to infected residents
- Consider the use of topical mupirocin ointment to eradicate MRSA carriage in the anterior nares of workers and residents
- Consult with local public health departments for advice and molecular typing of isolates to determine whether an outbreak is due to a single strain and to identify residents or staff who may be disseminating the organism

MRSA: Methicillin-resistant *Staphylococcus aureus*

Source: Prepared for Geriatrics by Shelly A. McNeil, MD, Lona Mody, MD, and Suzanne F. Bradley, MD

participation in group activities.^{6,20} Patients with wounds known to be colonized with MRSA need not have their activity restricted as long as appropriate wound care is maintained and the wound is appropriately covered.

Cohorting and isolation. Although cohorting and isolation of known nasal carriers of MRSA are sometimes used as control measures in LTCFs, routine use of these practices may not be practical or cost-effective.^{7,9} Given limited bed resources in LTCFs, these measures should be used judiciously. If transmission has not been documented by an increased rate of MRSA infection, most colonized or infected patients need not be cohorted or isolated.

On the other hand, some patients may deserve special consideration, including:

- those who have colonized tracheostomies and are coughing or unable to contain their secretions
- those with wounds that cannot be appropriately covered.

These patients could efficiently shed large quantities of MRSA into the environment with theoretical risk of transmission. They should be placed in a private room on contact precautions until productive cough has subsided and wound drainage can be contained.

Asymptomatic colonized residents implicated in outbreaks of infection should be cohorted or isolated. Decolonization of asymptomatically colonized residents or health care personnel should be attempted only if they have been implicated in transmission of infection.

Outbreak control measures

When infection control surveillance identifies a higher-than-baseline rate of MRSA infection within an institution, an outbreak may be occurring and more aggressive infection control measures may be necessary. All LTCFs should have an established protocol in place in the event of such an occurrence (table 3).

During outbreaks of symptomatic MRSA infection, isolation or cohorting of infected cases and screening of staff and other residents who have been in close proximity or in direct contact with infected patients should be carried out. Only MRSA carriers linked to infection cases should be placed in isolation.

Colonized healthcare workers who have been implicated in the transmission of MRSA to infected residents should be removed from duty until cleared of MRSA. The use of topical

mupirocin (Bactroban Nasal) ointment can successfully eradicate MRSA carriage in the anterior nares within several days,¹² and its use may be particularly warranted during an MRSA outbreak when routine infection control measures have been unsuccessful. The use of mupirocin in this situation permits the rapid return of colonized staff to work and may reduce the possibility of transmission by MRSA-colonized residents involved in the outbreak.

Oral antibiotics such as trimethoprim/sulfamethoxazole in combination with rifampin have been used to decolonize patients with MRSA, but resistance has emerged. No cross-resistance between mupirocin and antibiotics used to treat infection exists, making mupirocin the preferred agent for decolonization.²

To ascertain whether observed increases in MRSA infection rates truly represent an outbreak due to a single strain and to identify residents or staff who may be spreading the organism, consultation with local public health departments for advice and molecular typing of isolates may be useful.

Summary

Infection control measures for MRSA should be based upon the specific needs of an individual LTCF and should be directed at preventing costly, often difficult to treat, symptomatic infection with MRSA. All LTCFs should maintain an active surveillance program designed to monitor baseline MRSA infection rates. Any increase in the number of infections over the baseline rate should prompt initiation of more aggressive infection-control measures.

Early consultation with local health departments and molecular typing of MRSA isolates from infected residents and contacts should be performed:

- to establish whether increased infection rates truly represent an outbreak
- and to identify residents or staff who may be spreading the outbreak strain. In such instances, contact isola-

tion or cohorting of MRSA-infected cases as well as residents linked to transmission of infection is necessary.

Existing infection-control policy within the institution, with special attention to hand washing, must be enforced. During outbreaks of infection, topical antibiotics should only be used short-term for decolonization of implicated residents and staff. ☐

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