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The Potential Regional Impact of Contact Precaution Use in Nursing Homes to Control Methicillin-Resistant *Staphylococcus aureus*

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Abstract

OBJECTIVE—Implementation of contact precautions in nursing homes to prevent methicillin-resistant *Staphylococcus aureus* (MRSA) transmission could cost time and effort and may have wide-ranging effects throughout multiple health facilities. Computational modeling could forecast the potential effects and guide policy making.

DESIGN—Our multihospital computational agent-based model, Regional Healthcare Ecosystem Analyst (RHEA).

SETTING—All hospitals and nursing homes in Orange County, California.

METHODS—Our simulation model compared the following 3 contact precaution strategies: (1) no contact precautions applied to any nursing home residents, (2) contact precautions applied to those with clinically apparent MRSA infections, and (3) contact precautions applied to all known MRSA carriers as determined by MRSA screening performed by hospitals.

RESULTS—Our model demonstrated that contact precautions for patients with clinically apparent MRSA infections in nursing homes resulted in a median 0.4% (range, 0%–1.6%) relative decrease in MRSA prevalence in nursing homes (with 50% adherence) but had no effect on hospital MRSA prevalence, even 5 years after initiation. Implementation of contact precautions (with 50% adherence) in nursing homes for all known MRSA carriers was associated with a median 14.2% (range, 2.1%–21.8%) relative decrease in MRSA prevalence in nursing homes and a 2.3% decrease (range, 0%–7.1%) in hospitals 1 year after implementation. Benefits accrued over time and increased with increasing compliance.

CONCLUSIONS—Our modeling study demonstrated the substantial benefits of extending contact precautions in nursing homes from just those residents with clinically apparent infection to all MRSA carriers, which suggests the benefits of hospitals and nursing homes sharing and coordinating information on MRSA surveillance and carriage status.

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The use of contact precautions in nursing homes to control the spread of methicillin-resistant *Staphylococcus aureus* (MRSA) is a continuing area of debate. MRSA carriers (both symptomatic and asymptomatic) are known to transmit MRSA by contact with others and to shed extensively into the environment, which can also lead to transmission of MRSA.[1–7] Contact precautions (ie, assignment of MRSA carriers to single or cohorted rooms and use of gowns and gloves by healthcare providers) are the first line of defense in hospitals and have been shown to curb MRSA transmission.[8–10] Contact precautions could potentially be even more effective in nursing homes where MRSA carriers concentrate[11–15] and social interaction between residents is encouraged. Such precautions are also a primary line of defense in nursing homes, but they are recommended selectively for MRSA patients who are actively infected or who have wounds or uncontained secretions.[16] Unnecessary use of contact precautions should be avoided, because they are associated with known negative consequences; they reduce medical visits by providers and may lead to depression and potential fall risk because of lack of attention. In addition, preservation of interpersonal interactions is vital to the well-being of nursing home residents.[17–20]

Although current guidelines include recommendations for contact precautions to prevent MRSA transmission in nursing homes,[16,21] most studies of the effectiveness of contact precautions have focused on hospitals rather than nursing homes.[22] Because patient admission, mixing, and length of stay (LOS) patterns in nursing homes are quite different from those in hospitals, implementation of contact precautions in nursing homes may have different effects.[16] Moreover, because nursing homes frequently receive patients from and send patients to hospitals,[23] contact precautions in nursing homes may affect hospitals in the region and vice versa. Computational agent-based models (ABMs) can serve as virtual laboratories and allow stakeholders to test population-level interventions that would otherwise entail considerable trial and error. ABMs can help guide infectious disease policy making and elucidate complex dynamic effects of an intervention. They can also guide data collection and identify important data elements and their value. For instance, our ABM of the hospitals in Orange County (OC), California, demonstrated the synergistic effects that arise from cooperation in infection control (ie, hospitals can achieve greater infection control by cooperating than they ever could alone).[24] It also showed the importance of knowing and improving compliance with infection control measures. To address the question of contact precautions in nursing homes, we further developed our detailed ABM to include all healthcare facilities (hospitals and nursing homes) in OC and evaluate whether control of MRSA is improved after institution of various contact precaution strategies in nursing homes, beyond the standard use of contact precautions in hospitals.

METHODS

Model Structure

We added virtual representations of all 71 nursing homes (long-term care facilities) in OC to our ABM, the Regional Healthcare Ecosystem Analyst (RHEA),[25] which previously consisted of all 29 adult hospitals (including 5 long-term acute care facilities [LTACs]); this allowed us to capture how all 100 inpatient facilities interact via patient sharing. Each virtual hospital consisted of 20-bed general wards and 12-bed intensive care units (ICUs). The LTACs had 10-bed wards, and nursing homes had a single ward.

Model data came from several sources, including a state mandatory hospitalization data set, a national long-term care data set (minimum data set [MDS]), and hospital and nursing home surveys.[26–29] Rates of hospitalization and rehospitalization were obtained from a 2007 California mandatory hospital data set with a unique identifier to track patients between facilities.[26] Transfers between hospitals and nursing homes were based upon surveys (2006–2008) detailing interfacility transfers.[29] Data on nursing home characteristics, such as the

number of licensed beds, the average daily census, and LOS came from MDS.[27] Each patient who entered a facility could be a MRSA carrier or noncarrier; data on MRSA prevalence for both hospitals and nursing homes came from regional surveys and patient screenings.[11,29] Table 1 shows our model inputs and characteristics for the OC healthcare facilities.

Our RHEA model included computational virtual patients (ie, agents) that moved among and between the community and the healthcare facilities (Figure 1) and represented all patients (including MRSA carriers and noncarriers). Like a real patient, each agent could have a variety of sociodemographic and clinical characteristics, including MRSA carriage test result and actual MRSA colonization status. After a patient was admitted to a hospital, he or she resided in either a general ward or ICU (or, in the case of an LTAC, a long-term acute care unit) and stayed for a certain LOS, pulled from a specific LOS distribution (ICU specific and non-ICU specific) for each hospital. Patients mixed homogenously within the same ward but not across wards. Patients who were MRSA carriers experienced a longer LOS (based on actual facility-specific distribution for MRSA carriers) in hospitals.[26] Once a patient's hospital LOS elapsed, he or she took one of several pathways: discharge to the community, transfer to another hospital, or transfer to a nursing home. Transfers to another hospital could be either direct (ie, from one facility to another within the same calendar day without an intervening stay in a nursing home or the community) or indirect (ie, readmissions within 1 year of discharge). Patients transferred to a nursing home stayed there for a LOS specific to that facility based on actual data. After a nursing home resident's LOS elapsed, he or she could follow one of several pathways: discharge to the community, transfer to another nursing home, or admission to a hospital. In addition, consistent with nursing home–specific MDS data, each nursing home resident with a LOS of 14 days or longer had a daily probability of being transferred briefly to a hospital with his or her nursing home bed held until his or her return.

MRSA Transmission

Each day, virtual patients within a given ward or unit mixed homogenously with one another. The following equation determined the number of new MRSA cases per day in a given ward or unit:

$$\text{NO. of new MRSA cases/unit/day} = \beta S_\Phi I_\Phi + \beta(1-\theta) S_\Phi I_\Phi + \beta(1-\theta) S_\Phi I_p + \beta(1-\theta)^2 S_p I_p, \quad (1)$$

where β is the transmission coefficient (ie, rate at which infection is transmitted from an infectious individual to a susceptible individual); S is the number of susceptible individuals and I is the number of infectious individuals that day in that ward or unit; θ is efficacy of contact precautions (the degree of adherence to and execution of precaution procedures; eg, θ of 75% means a 75% reduction in contact with other patients); p and Φ indicate those patients under contact precautions and those not under contact precautions that day in that ward or unit, respectively. Hospital-specific transmission coefficients targeted incidences of 1%, 2%, and 3% in each general ward, LTAC ward, and ICU, respectively.[25] Nursing home βs came from actual admission prevalence data and point prevalence screenings (from 40% of nursing homes, which had a mean acquisition risk of 16%).[30] For those not sampled, estimated values were extrapolated from generalized linear mixed models that estimated carriage risk and incident disease on the basis of facility-level risk factors, including case mix. As a result, β reflected the differences in MRSA susceptibility among patients in different nursing homes and hospitals.

We assumed one-third of MRSA carriers had indefinite carriage.[31] The remaining two-thirds experienced a linear carriage loss with a half-life of 6 months.[32,33]

Hospital Contact Precautions

All scenarios assumed 2 activities were occurring in all OC hospitals: (1) active MRSA testing of all patients (currently, California law requires MRSA admission screening of many hospitalized patients, including those hospitalized within the past 30 days, patients who receive hemodialysis, ICU patients, nursing home residents, and those who undergo surgical procedures[34]) immediately at hospital admission with a 75% sensitivity, 97.1% specificity, and a 2-day turnaround time,[35] and (2) contact precautions for all patients with a known history of MRSA or a test result positive for MRSA at hospital admission screening (regardless of true colonization status; ie, including both true and false positives).

Nursing Home Contact Precaution Scenarios

Our 3 experimental scenarios focused on the following nursing home contact precaution policies (Figure 1): (1) No contact precautions applied to any nursing home residents. (2) Contact precautions only for those with clinically apparent MRSA infection. MRSA carriers had a 5% probability of having clinically apparent MRSA infection upon nursing home admission and a 10% probability of developing a clinically apparent MRSA infection[12] during their nursing home stay. Contact precautions consisted of single or cohorted rooms, staff wearing gowns and gloves on room entry, and infected residents wearing gowns and gloves when exiting their rooms. Infections (and resultant contact precautions) were assumed to persist for 10 days or until discharge, whichever came first. On transfer to a hospital, contact precautions persisted, and those patients who were not under contact precautions were screened and isolated depending on the test result. (3) Contact precautions applied to all known MRSA carriers identified by hospital MRSA screening. Contact precautions were applied for the duration of the hospital or nursing home stay. When a resident who was under contact precautions in a nursing home was transferred to a hospital, contact isolation was continued, and vice versa.

Sensitivity analyses systematically varied contact precaution adherence (range, 25%–75%) in all OC healthcare facilities. Three nursing homes had limited data and were excluded from the analysis (leaving 68 total nursing homes). We performed t tests to determine the significance of the different contact precaution strategies.

RESULTS

Implementation of Nursing Home Contact Precautions for Residents with a Clinically Apparent MRSA Infection

Table 2 shows the median percentage decrease in MRSA prevalence that resulted from our model simulations. Implementation of contact precautions for those with clinically apparent MRSA infection had minimal effect (nearly always < 1%) on MRSA prevalence in hospitals and nursing homes, even when contact precaution adherence was 75%. Moreover, not every nursing home and hospital experienced a relative decrease in MRSA prevalence when individuals with clinically apparent infection were under contact precautions (with 50% adherence, 13 of 68 nursing homes and 14 of 29 hospitals did not experience a reduction). For those facilities that experienced a decrease in MRSA prevalence, the reduction was significant ($P < .05$) in 16.7% (11 of 66 facilities) at 6 months (50% adherence).

Table 3 shows the total number of new MRSA acquisitions averted in the simulated county after 0.5, 1, 2, 3, 4, and 5 years after implementation of each contact precaution strategy. Again, contact precautions (50% adherence) in nursing homes for residents with overt MRSA infection produced minimal reductions in regional MRSA prevalence in health-care facilities. This strategy averted a total of only 10 MRSA acquisitions countywide within 6 months.

Implementation of Nursing Home Contact Precautions for All Known MRSA Carriers

In contrast to implementation of contact precautions for just those individuals with overt disease, implementation of contact precautions for all identified MRSA carriers in nursing homes in our model yielded substantial decreases in MRSA prevalence in both hospitals and nursing homes (Table 2). In hospitals, MRSA prevalence initially decreased by a median of 1.1% within 6 months but increased to a reduction of 5.9% after 5 years. Improving adherence proportionately increased the change in relative MRSA prevalence in all OC healthcare facilities. The MRSA prevalence reductions were significant ($P < .05$) for 74.7% of hospitals that experienced a decrease (20 of 27 hospitals) within 6 months (25% adherence or greater).

In our simulated nursing homes, MRSA prevalence decreased by a median of 4.7% within 6 months after contact precautions were employed for all known MRSA carriers. This increased to a 25.5% reduction after 5 years. This reduction magnitude was 31 times greater than that achieved when contact precautions were employed (50% adherence) for only those individuals with clinically apparent infection at 6 months, and it was 72 times greater at 5 years. With 75% adherence, MRSA prevalence in nursing homes decreased by 6.9% after 6 months and by 40.4% after 5 years. These reductions were significant in 98.5% of nursing homes (67 of 68; 25% adherence) at 6 months.

Figure 2 shows the simulated impact on MRSA prevalence in specific facilities when contact precautions for all known MRSA carriers are implemented in all nursing homes with 50% adherence. The reduction in MRSA prevalence accrues over time. Figure 2*a* shows the impact on the largest hospital when nursing homes implemented contact precautions for all known MRSA carriers. This reduction represented a 0.6% relative decrease in MRSA prevalence after 6 months and a 4.8% reduction after 5 years. The smallest hospital also experienced a 1.5% relative decrease after 6 months and a 5.1% reduction after 5 years. Nursing homes experienced greater reductions than hospitals, as noted above.

In our model, use of contact precautions for all known MRSA-positive nursing home residents resulted in substantial reductions in MRSA transmission and prevalence over time. Table 3 shows the total number of MRSA acquisitions averted after implementation of contact precautions in nursing homes compared with the number of MRSA acquisitions without implementation of contact precautions. There were 171 MRSA acquisitions averted within 6 months, and 4,876 acquisitions were averted within 5 years (50% adherence).

DISCUSSION

Our modeling study delineates the regional impact of different contact precaution strategies in nursing homes. The common strategy of applying contact precautions for only those residents with clinically apparent infection appears to yield marginal benefits in curbing transmission. The high degree of social interaction in nursing homes seems to overwhelm the brief and limited use of contact precautions, even when adherence to contact precautions is as high as 75%.

By contrast, our modeling study shows that applying contact precautions for all known MRSA carriers yielded substantial reductions (at adherence levels of 50% or greater, which is at or below that reported in the literature[36,37]) in MRSA prevalence in nursing homes countywide and that these reductions grow over time. This broader use of contact precautions may be necessary to counterbalance the high transmission pressure from the relatively high MRSA prevalence in nursing homes (mean prevalence of 25% in OC).[11,38] Increased adherence led to additional reductions.

This modeling study is novel in its focus on the nursing home setting. A deterministic mathematical model by D'Agata et al,[39] which focused on a single hospital and did not consider patient transfers, estimated that an increase in contact precaution compliance decreased the prevalence of colonization with multidrug-resistant organisms. Barnes et al[40] and Lesosky et al[41] have both constructed mathematical models that include hospitals and nursing homes. Neither simulated the effects of contact precautions. In addition to these differences in modeled outcomes, these models have important limitations. First, the models in Barnes et al[40] and Lesosky et al[41] were theoretical and highly simplified. In direct contrast, our model represented actual regional hospitals and nursing homes in a large US county and was parameterized with extensive facility-specific data, including admission volume, ICU volume, bed capacity, LOS, and actual transfer matrices of where patients from each facility tended to be admitted, transferred, and readmitted over time. In addition, we used extensive epidemiologic data from this region on facility-specific MRSA carriage and transmission to create as close an approximation of a real-world model as is currently available.

Contact precautions have potential drawbacks and are associated with certain obstacles. The Centers for Disease Control and Prevention acknowledges possible adverse effects as a result of stigma or isolation, such as anxiety, depression, and reduced visits by medical staff, and recommends that facilities seek ways to counteract these potential detrimental outcomes.[10] Contact precautions require resources that may be limited in nursing homes[42,43] and could detract from the homelike environment that nursing homes aim to maintain. Nursing homes must weigh the benefits of contact precautions against the costs. Our study highlights the potential additional benefits of contact precautions and hopefully will motivate future work to pinpoint ways to reduce these costs and obstacles.

Importantly, we demonstrate that effective concerted strategies that are applied to all nursing homes can have positive regional effects that are magnified over time. In this study, we found that contact precautions for MRSA carriers not only continued to reduce MRSA prevalence in nursing homes over time but also reduced MRSA prevalence in hospitals. In fact, 5 years after policy implementation in all OC nursing homes, there were 4,876 fewer MRSA carriers across all OC hospitals and nursing homes, including 230 fewer MRSA carriers in hospitals. When adherence to contact precautions increased from 50% to 75% in all OC nursing homes, there were 7,291 fewer MRSA carriers countywide 5 years after implementation. This was true despite the fact that contact precautions were already in use in hospitals. The potential impact of contact precautions would also depend on the sensitivity of MRSA screening tests; effective screening methodologies should be adopted to detect the maximum number of cases.

Limitations

Our model assumed homogeneous mixing within nursing homes and hospital wards and units. In addition, our study used actual measured MRSA prevalence in nursing homes and did not vary these levels. We did not include the potential effects of contact precautions on other antibiotic-resistant organisms. Our model did not include the potential adverse consequences of contact precautions.[19,42,43] Finally, all models are simplifications of real-world conditions and cannot include all details. Regional studies in nursing homes will be needed to confirm findings.

Conclusions

Our ABM, calibrated with extensive real-world data from hospitals and nursing homes, favored a more comprehensive contact precaution strategy in nursing homes, including implementation of contact precautions for all patients with MRSA carriage history, rather

than just for those individuals with clinically apparent infection. The benefits extended beyond the nursing homes that employed such a strategy to include all OC healthcare facilities. A more comprehensive approach should also include appropriate measures to cope with the negative impacts of isolation. Alternatively, this approach can be selectively implemented during outbreak situations or when endemic prevalence continues to increase unabated. Finally, the effectiveness of contact precautions for known carriers serves as a benchmark to understand the value of other infection prevention strategies that do not have a negative influence on the nursing home environment and patient mental health.

Acknowledgments

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Overview of Patient Movement in RHEA Among Healthcare Facilities (Hospitals and Nursing Homes) and the Community

In each healthcare facility: New MRSA cases = $\beta S_{\phi} I_{\phi} + \beta(1-\theta) S_p I_{\phi} + \beta(1-\theta) S_{\phi} I_p + \beta(1-\theta)^2 S_p I_p$ where β = ward/facility's transmission coefficient; S_p = susceptible under precautions; S_{ϕ} = susceptible under no precautions; I_p = infectious under precautions; I_{ϕ} = infectious under no precautions; and θ = contact precaution adherence
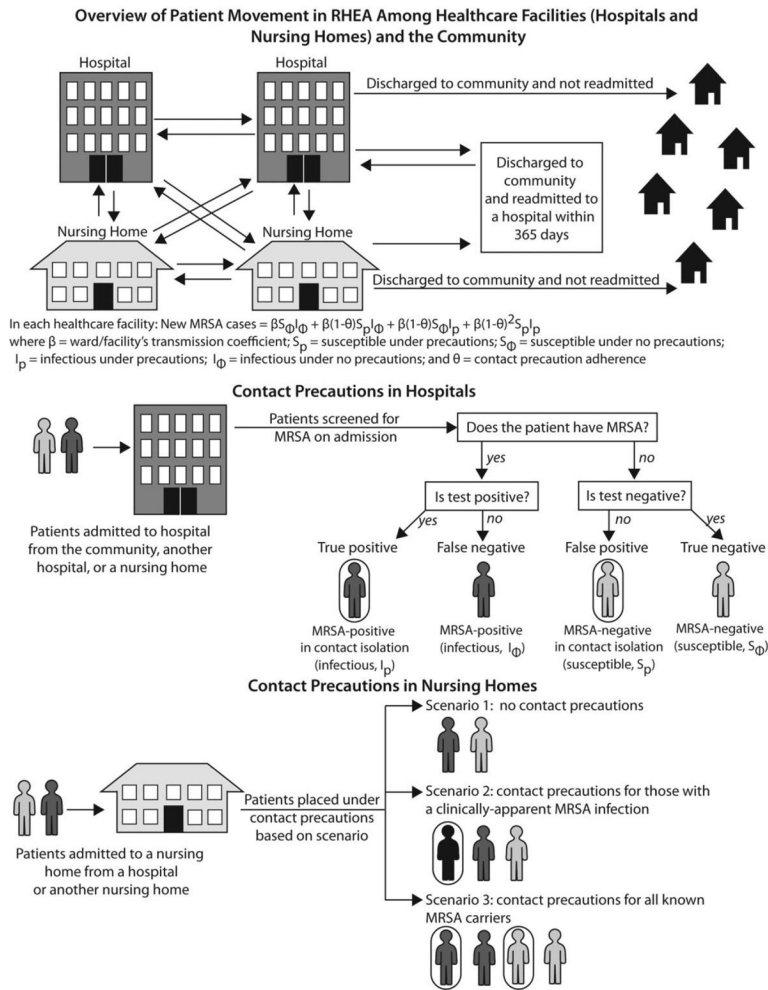
FIGURE 1.
Overview of patient movement in Regional Healthcare Ecosystem Analyst (RHEA) among hospitals and nursing homes and contact precaution scenarios. MRSA, methicillin-resistant *Staphylococcus aureus*.
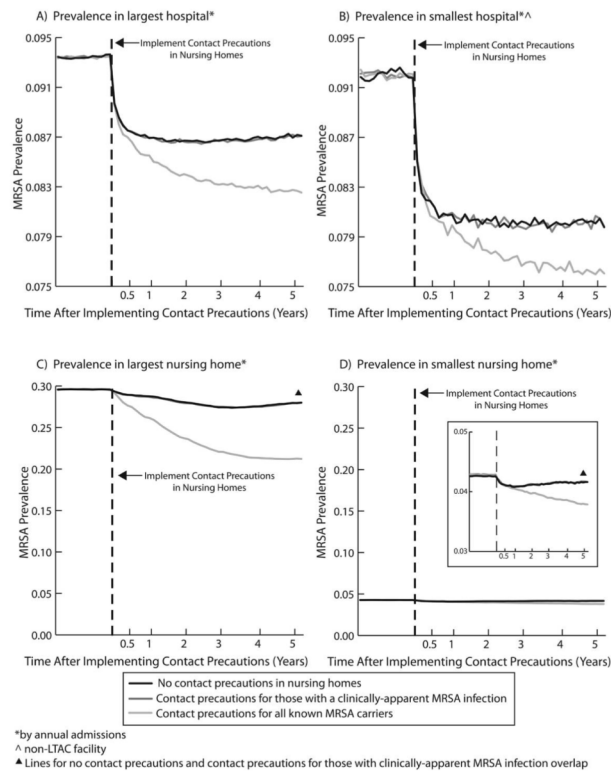
FIGURE 2.
Change in methicillin-resistant *Staphylococcus aureus* (MRSA) prevalence over time in select Orange County healthcare facilities for 3 contact precaution scenarios implemented in nursing homes with a 50% compliance rate. *A*, Largest hospital by number of admissions; *B*, smallest hospital by number of admissions; *C*, largest nursing home by number of admissions; *D*, smallest nursing home by number of admissions. LTAC, long-term acute care facility.

TABLE 1

Orange County Hospital and Nursing Home Characteristics and Model Input Parameters

Variable	Hospitals (*n* = 29)		Nursing homes (*n* = 71)	
	Mean value (±SD)	Median value (range)	Mean value (±SD)	Median value (range)
Annual adult admissions	8,826.7 (6,780.5)	7,033 (425–27,151)	504.5 (862.6)	311 (3–7,080)
Licensed beds	228.6 (120.2)	194 (48–505)	108.6 (58.0)	99 (9–300)
Average daily census	131 (90)	103 (16–368)	86.7 (43.2)	85.3 (9–214)
Length of stay, days	5.4 (7.6)	4 (1–626)	210.5 (447.4)	37 (1–5,066)
MRSA prevalence, %	6.1 (5.4)	3.4 (1.1–18.5)	26.1 (8.6)	25.9 (0–52)
Transmission coefficient (β)	0.0099 (0.0402)	0.0017 (0–0.2966)	0.000082 (0.000056)	0.000068 (0–0.00030)
LOS for MRSA-positive patients, days	12 (16.1)	8 (1–414)	...	...
No. of discharges to community	4,598.6 (4,075.6)	2,699 (134–16,541)	378.7 (311.4)	333 (17–1,172)
No. of transfers				
Directly to hospitals	91.3 (58.9)	80 (17–261)	74.0 (66.4)	58 (0–261)
Directly to nursing homes	806.1 (666.3)	679 (38.5–2,616)	10.5 (10.9)	8 (0–64)
Hospital readmissions	2,401.1 (1,880.7)	1,810 (82–7,178)	354.2 (332.4)	249 (19–1,403)
Time to readmission, days	93.9 (100.6)	52 (1–366)	90 (96.2)	50 (1–366)
No. of brief hospitalizations	...	...	291.5 (224)	248 (0–1,584)
Length of brief hospitalization, days	...	...	5.8 (6.1)	5 (0–14)

NOTE. MRSA, methicillin-resistant *Staphylococcus aureus*. LOS, length of stay.

TABLE 2

Percentage Relative Decrease in Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection Prevalence in Hospitals and Nursing Homes after Implementation of Different Contact Precaution Strategies in Nursing Homes

Contact precaution adherence	Relative reduction, median % (range), by no. of years after implementation of contact precautions in all OC nursing homes					
	0.5	1	2	3	4	5
Nursing home residents with clinically apparent MRSA infection						
Reduction in MRSA infection prevalence per OC hospital, %						
25	0.0 (NE to 1.0)	0.1 (NE to 0.6)	0.0 (NE to 0.8)	0.1 (NE to 1.3)	0.2 (NE to 1.2)	0.2 (NE to 1.6)
50	0.0 (NE to 0.6)	0.0 (NE to 0.4)	0.1 (NE to 0.6)	0.1 (NE to 0.8)	0.1 (NE to 0.6)	NE (NE to 1.2)
75	0.0 (NE to 0.5)	0.1 (NE to 0.6)	0.1 (NE to 0.6)	0.2 (NE to 1.3)	0.3 (NE to 1.6)	0.3 (NE to 0.7)
Reduction in MRSA prevalence per OC nursing home, %						
25	0.1 (NE to 0.5)	0.1 (NE to 0.5)	0.1 (NE to 1.4)	0.2 (NE to 1.1)	0.2 (NE to 1.0)	0.2 (NE to 1.0)
50	0.2 (NE to 1.2)	0.2 (NE to 1.9)	0.3 (NE to 1.0)	0.3 (NE to 1.3)	0.4 (NE to 1.3)	0.4 (NE to 1.6)
75	0.2 (NE to 1.1)	0.3 (NE to 1.3)	0.5 (NE to 1.0)	0.5 (NE to 1.3)	0.6 (0.1–1.5)	0.6 (NE to 1.6)
All known MRSA carriers in OC nursing homes						
Reduction in MRSA prevalence per OC hospital, %						
25	0.6 (NE to 1.9)	1.2 (NE to 3.8)	2.1 (0.5–5.5)	2.3 (0.3–6.3)	2.7 (0.3–7.6)	3.0 (0.5–7.3)
50	1.1 (NE to 3.8)	2.3 (NE to 7.1)	4.1 (0.6–11.0)	4.7 (0.9–13.6)	5.6 (0.7–14.9)	5.9 (0.3–17.0)
75	1.9 (0.4–5.5)	3.3 (NE to 11.3)	6.2 (1.1–17.5)	7.3 (1.4–20.9)	8.2 (1.4–23.0)	9.5 (1.6–25.1)
Reduction in MRSA prevalence per OC nursing home, %						
25	2.3 (0.5–4.1)	4.7 (1.2–7.1)	8.1 (2.0–10.5)	10.0 (3.2–12.6)	11.3 (2.8–14.4)	12.3 (3.7–15.2)
50	4.7 (0.3–9.2)	9.3 (0.6–14.4)	15.9 (3.6–21.5)	20.4 (5.6–26.0)	23.8 (7.1–29.9)	25.5 (8.6–31.7)
75	6.9 (0.5–12.8)	14.2 (2.1–21.8)	24.7 (5.2–33.1)	31.4 (9.0–40.2)	36.5 (12.0–45.6)	40.4 (16.3–54.4)

NOTE. NE, no effect; OC, Orange County.

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TABLE 3

Total Number of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Acquisitions Averted Countywide after Implementation of Contact Precaution Strategies in Orange County (OC) Nursing Homes

Contact precaution adherence	No. of MRSA acquisitions averted, by no. of years after implementation of contact precautions in all OC nursing homes					
	0.5	1	2	3	4	5
OC nursing home residents with clinically apparent MRSA, %						
25	0	3	15	22	35	53
50	10	18	33	56	78	102
75	10	23	47	76	100	119
All known MRSA carriers in OC nursing homes, %						
25	81	258	727	1,259	1,837	2,442
50	171	526	1,437	2,507	3,662	4,876
75	251	772	2,132	3,727	5,461	7,291