The Role of Wound Care in 2 Group A Streptococcal Outbreaks in a Chicago Skilled Nursing Facility, 2015–2016

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Two consecutive outbreaks of group A Streptococcus (GAS) infections occurred from 2015–2016 among residents of a Chicago skilled nursing facility. Evaluation of wound care practices proved crucial for identifying transmission factors and implementing prevention measures. We demonstrated shedding of GAS on settle plates during care of a colonized wound.

Keywords. group A Streptococcus; healthcare-acquired infection; outbreak; wound infection; vacuum-assisted closure.

Residents of skilled nursing facilities (SNFs), particularly those with wounds or receiving wound care, are vulnerable to group A Streptococcus (GAS) infections [1, 3, 4], infections spread by respiratory droplets or direct contact with ill or colonized persons [2]. Whether this increased risk is caused by residents' contact with potentially ill or colonized staff, contaminated wound care tools, or exposure to specific wound care practices is typically unknown [3–5].

In August 2015, the Chicago Department of Public Health (CDPH) reported an invasive GAS infection and death in a resident of a 228-bed, postsurgical/acute rehabilitation SNF. The facility specializes in wound care and orthopedics. Active surveillance identified 3 additional GAS infections from December 2015 to January 2016. All infected residents had wounds; 3 received therapy with wound vacuum-assisted closure devices (VACs), foam dressing attached to a pump providing negative pressure to promote healing [6]. In December, the CDPH visited the facility to observe wound care and noted poor wound cleaning. The CDPH recommended changing soiled diapers/linen before dressing changes and use of facemasks for irrigation, although no issues were apparent. After 3 new cases occurred in March 2016, the CDPH and the Centers for Disease Control and Prevention (CDC) conducted an investigation to review specific wound care practices, identify unrecognized infection control gaps, and halt the outbreak.

METHODS

To identify additional GAS cases, we reviewed resident admissions to local hospitals, facility records, and staff absentee logs from August through December 2015. Staff contact with cases was identified by reviewing staff room and wound care nurse floor assignments. We reviewed case bed assignments to identify shared rooms.

We defined an invasive case as illness in a SNF resident or staff member with GAS cultured from a normally sterile site (eg, blood) during the outbreak period (July 17, 2015–March 31, 2016). A noninvasive case was defined as illness in a resident or staff member with GAS detected from a throat or wound by culture or rapid antigen detection. We defined colonization as detection of GAS from a throat or skin swab of an asymptomatic person.

We conducted 2 colonization surveys: December 2015–January 2016 and March 21–31, 2016. Swabs were cultured for GAS using standard methodology [7].

We conducted a matched case–control study among residents with wounds to identify infection risk factors. Each case resident was matched to 3 residents without GAS infection or colonization (controls) by age (<20 years from case resident's age) and timing of facility stay (overlapping with case residence by at least 1 day in the 15 days before case culture). Demographic and clinical data were abstracted from medical charts. We calculated matched odds ratios using conditional logistic regression and used t tests to compare continuous variables. Multivariable analysis to identify independent risk factors was precluded by small numbers.

We observed staff performing hand hygiene, point-of-care testing, disinfection of shared equipment, wound care activities (eg, dressing changes, wound VAC management), and personal protective equipment (PPE) use. Using a standardized employee survey, we evaluated self-reported infection control practices in comparison with observed practices.

To assess GAS shedding from infected or colonized wounds during wound care, we placed nonselective and selective (containing colistin and nalidixic acid) blood agar plates directly below and adjacent to the wounds (with unknown GAS...
colonization status) of 5 residents either currently or recently receiving wound VAC therapy. Residents were positioned in a lateral decubitus or recumbent position, based on wound location. Plates remained in place until dressing removal, wound cleaning, and application of new dressings were complete.

GAS isolates were sent to the CDC’s Streptococcus laboratory for emm typing [8].

RESULTS
From July 2015 to March 2016, we identified 7 GAS cases (6 invasive and 1 noninvasive) in residents with postsurgical wounds or decubitus ulcers and 5 GAS cases (all pharyngitis) in staff members (Supplementary Figure 1). Review of sick leave requests and employee surveys identified 2 probable staff cases (physician-diagnosed illness). More than 40% (436/1080) of SNF residents had wounds during the outbreak period. Three teams (including a wound VAC management team) were dedicated to wound care.

The first colonization survey (December 2015‒January 2016) targeted all staff and residents; GAS was cultured from the oropharynx of 3 of 354 (0.8%) staff. Among 158 residents' oropharyngeal swabs, none grew GAS. The wounds of 3 (9.7%) of 31 residents suspected of infection (ie, erythema, drainage, warmth) grew GAS. The second colonization survey (March 21‒31, 2016) targeted staff epidemiologically linked to March 2016 resident cases and residents with wounds or potentially infected percutaneous devices. GAS was cultured from 4 staff (4 oropharyngeal cultures from 99 staff; 0 swabs of skin breaks from 7 staff) and 2 residents (2 cultures of wounds or percutaneous device sites of 64 residents). One staff member was GAS-positive in both surveys with the same strain (not an outbreak strain).

All GAS cultured from 4 infected and 3 colonized residents before January 31, 2016, were emm87; GAS isolated from 3 colonized staff were other emm types (isolates unavailable from ill staff). Beginning March 2016, a different strain (emm89) was identified in 2 infected and 2 colonized residents and 1 colonized staff. One resident was infected, and 1 staff member colonized with emm87 other emm types of 2 colonized staff: emm81 and emm28 and one infected staff: 3.116).

Seven infected residents and 21 matched controls were enrolled in the case-control study. Infected residents were more often obese (75% vs 33%, P = undefined) and more frequently received treatment with antimicrobial ointment (57% vs 5%, P = .03) and wound VACs (86% vs 10%, P = undefined) than controls (once concordant matched pairs were removed, there were no cases with normal body mass indexes [BMIs] to compare with those with abnormal BMIs; similarly, after removing concordant pairs, there were none without wound VACs to compare) (Table 1).

Lapses in infection control practices were noted during wound care observations. Wound teams routinely irrigated all wounds with saline pods without wearing facemasks. Wound nurses failed to don PPE before entering rooms of residents on contact precautions and stored used gloves in their pockets. However, no obvious breaches in infection control practices during use of wound care products (eg, antimicrobial ointment) were noted. Stool leakage was noted under a wound VAC dressing seal that did not trigger a system alarm; the nurse needed prompting to clean the fecal-contaminated wound before reapplying the dressing.

Appropriate hand hygiene was reported by 92% of 132 surveyed employees but observed in only 62% (13/21). Only 1–8 alcohol-based hand rub dispensers were available on each floor. Staff did not consistently clean and disinfect shared equipment (eg, chair scales) before subsequent use.

Two settle plates placed below 1 resident’s sacral wound during wound VAC dressing change (which included irrigation with saline pods) grew GAS emm89. After observing fecal contamination of the wound upon removal of the wound VAC, rectal and wound swabs were obtained and grew the same strain. No GAS grew on settle plates of the remaining 4 residents.

DISCUSSION
Wounds are a well-known risk factor for GAS infections [9]. This investigation was the first to document shedding of GAS from a colonized wound during wound care. Although the initial introduction of GAS into this facility may have occurred via staff working while ill with GAS pharyngitis or residents admitted to the facility while colonized or ill, we hypothesize that saline irrigation of GAS-colonized or infected wounds contributed to continued transmission through dispersal of GAS-laden droplets. In this context, any breaches in infection control may have enabled intrafacility disease transmission indirectly to residents through contaminated hands of staff or directly to staff providing wound care without use of facemasks.

All wound teams were observed irrigating residents’ wounds in a similar fashion without recognizing that spraying sterile saline may lead to splashing of body fluids. Current infection control guidelines [10] mention protecting mucous membranes against splashing when managing uncovered wounds or when drainage is not contained by dressings. Maragakis et al. [11] linked the shedding of Acinetobacter baumannii during low-pressure pulsatile lavage of wounds to a healthcare–associated outbreak; thereafter, use of facemasks by staff was reinforced and a private room used during low-pulsatile lavage to prevent indirect transmission to residents.

Similar to an earlier GAS investigation [5], we identified wound VACs as a risk for GAS infection. However, wound VACs and use of antimicrobial cleansers may simply be markers for large, deep, poorly healing wounds.

Infection control lapses during wound VAC management likely contributed to GAS transmission. Staff hand hygiene compliance was low despite awareness of being observed. A resident
with a wound VAC had both rectal and sacral wound GAS colonization, suggesting that the observed leakage of stool under the dressing seal or inadequate cleaning of the wound increased the risk for spread of organisms from the rectum.

Recommendations included treating all GAS-infected or colonized residents and staff with antibiotics and adopting a supportive sick leave policy. Wound teams were advised to wear facemasks, gowns, and gloves when performing wound dressing or wound VAC changes.

GAS can be shed from a colonized wound during wound care; careful review of wound care practices in SNFs is needed to identify unrecognized shedding. Wounds receiving wound VAC therapy are vulnerable to GAS infection and colonization, and training in best practices is paramount. Certain wound care practices (eg, wound debridement and irrigation) can be sources of cross-contamination. Hand hygiene and appropriate PPE use education, offering wound care training by certified staff, and routine audits may reduce wound care–associated GAS transmission. Early application of recommended infection control practices is essential to preventing transmission during outbreaks.

**Supplementary Data**

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.
Acknowledgments

We thank medical director Dr. Sarah Kemble, epidemiologists Robynn Leidig and Shamika Smith, and staff from the Chicago Department of Health; Whitney Clegg; and the Illinois Department of Public Health for participation in this outbreak investigation. We also thank the entire team at the Centers for Disease Control and Prevention Streptococcus laboratory for the molecular characterization of all clinical and environmental isolates. We also thank the facility’s director and assistant director of nursing, phlebotomist, wound care physician and nurses, and all other staff who supported investigative and intervention efforts.

Financial support. This work was supported by the Respiratory Diseases Branch of the Centers for Disease Control and Prevention.

Disclaimer. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Potential conflicts of interest. All authors: no reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

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