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Concise Communication

Impact of universal chlorhexidine bathing with or without COVID-19 intensive training on staff and resident COVID-19 case rates in nursing homes

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Abstract

We evaluated whether universal chlorhexidine bathing (decolonization) with or without COVID-19 intensive training impacted COVID-19 rates in 63 nursing homes (NHs) during the 2020–2021 Fall/Winter surge. Decolonization was associated with a 43% lesser rise in staff case-rates ($P < .001$) and a 52% lesser rise in resident case-rates ($P < .001$) versus control.

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Introduction

COVID-19 is transmitted primarily by the respiratory route, and secondarily through touch contact with infected persons or contaminated fomites. Recently, chlorhexidine antiseptic bathing soap was shown to reduce bacterial transmission and infections in nursing homes (NHs),[1] presumably due to known persistent antimicrobial effects on the skin of residents and the hands of healthcare workers who bathe them.[2] We evaluated whether universal decolonization might also, unexpectedly, mitigate COVID-19 spread in NHs.

Methods

A quasi-experimental study was conducted to assess the impact of universal decolonization with or without COVID-19 intensive training on COVID-19 outcomes in Orange County, California NHs, comparing baseline (April–September 2020) to the October 2020–March 2021 Fall/Winter surge.

On behalf of local public health and Medicaid agencies, our COVID-19 Prevention Team provided Orange County NHs with COVID-19 prevention guidance, protocols, and videos in an online toolkit (https://www.ucihealth.org/stopcovid). In addition, we selected 12 NHs for COVID-19 intensive training based on their Spring 2020 COVID-19 resident cases. In-person training sessions launched Summer 2020 (1 NH launched in September), focusing on staff safety, proper use of personal protective equipment, and environmental cleaning for all relevant work shifts. NHs also received weekly feedback reports and video montages about staff hand hygiene, masking, face-touching, and breakroom safety via video-based auditing.

Of the 12 COVID-19 intensive training NHs, 11 had adopted universal decolonization prior to the pandemic, involving chlorhexidine for routine bathing and twice daily nasal iodophor Monday–Friday every other week. An additional 13 NHs had adopted universal decolonization but did not receive COVID-19 intensive training. During the pandemic, all 24 NHs received weekly visits encouraging decolonization adherence using toolkit materials available at https://www.ucihealth.org/shield.

We evaluated outcomes of (1) staff COVID-19 case rates, (2) resident COVID-19 case rates, and (3) resident COVID-19 death rates among the 24 NHs participating in decolonization (and subsets with (11) or without (13) COVID-19 intensive training) versus non-participating (control) NHs. Daily COVID-19 case and death data from April 2020 to March 2021 were obtained from the California Health and Human Services Open Data Portal.[3]

Impact of decolonization was assessed using a difference-in-differences approach comparing incident rate ratios (IRRs) during baseline versus surge periods among decolonization versus control NHs. Negative binomial mixed effects models for count data tested the group-by-period interaction when clustering by NH and adjusting for each NH's baseline COVID-19 case rates, average daily census, average age, average Resource Utilization Group (RUG) score,[4] and proportion of long-stay residents

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Table 1. Nursing home characteristics

	Median (interquartile range) across nursing homes		
	Universal decolonization with COVID-19 intensive training	Universal decolonization without COVID-19 intensive training	Control nursing homes
Number of nursing homes	10	13	40
Licensed beds	96.0 (71.7–99.0)	99.0 (80.0–145.0)	99.0 (67.8–132.5)
Mean daily census	85.5 (76.0–110.8)	93.0 (78.0–136.0)	87.5 (52.6–116.5)
Mean age in years	80.0 (76.8–82.1)	79.0 (76.0–82.0)	80.0 (75.8–83.3)
% Female	57.3% (52.6–62.7%)	57.2% (55.9–64.1%)	57.9% (53.7–63.0%)
% Medicaid	54.4% (24.3–79.5%)	42.5% (30.4–76.0%)	55.4% (26.7–86.6%)
% Diabetes mellitus	37.9% (29.9–49.4%)	30.9% (26.0–41.9%)	39.1% (31.8–44.2%)
% Chronic lung disease	20.0% (18.6–23.4%)	21.2% (17.0–22.3%)	20.6% (14.1–24.2%)
% Renal failure	20.7% (19.5–24.1%)	18.2% (15.2–21.2%)	22.1% (15.6–24.6%)
% Long-stay >100 d	17.0% (7.6–26.3%)	21.3% (15.6–26.5%)	17.8% (8.8–26.5%)
Median length of stay in days	213.5 (196.3–230.0)	224.0 (206.0–228.0)	212.3 (200.6–229.9)
Resource utilization group score[a4]	1.4 (1.4–1.7)	1.3 (1.2–1.4)	1.3 (1.3–1.4)
CMS overall staffing rating[b]	3.0 (2.0–3.0)	2.0 (2.0–3.0)	3.0 (2.0–3.0)
CMS registered nurse staffing rating[b]	2.0 (2.0–3.0)	2.0 (2.0–3.0)	2.0 (2.0–3.0)

[a]The RUG score represents the level of care required for the average resident in a nursing home based on comorbidities and level of independence for activities of daily living, with a higher score indicating higher required resources (average across U.S. nursing homes is 1.2, range 0.6–3.5).
[b]The Centers for Medicare and Medicaid Services (CMS) star rating is a measure of nursing home staffing on a scale from 1 (lowest score) to 5 (highest rating). Of note, CMS describes: "Higher staffing ratings mean there are more nursing staff and less turnover of the staff, which may mean higher quality of care" (www.cms.gov/medicare/health-safety-standards/certification-compliance/five-star-quality-rating-system. opens in new tab).

(length-of-stay >100 days). This work was conducted as a non-research public health endeavor and was exempt for human subjects research review. All analyses were conducted in SAS 9.4 (SAS Institute, Cary NC).

Results

Of the 24 NHs participating in decolonization, one was excluded for incomplete data. Of the 49 control NHs, nine were excluded for incomplete data, leaving 40 control NHs to be compared to 23 decolonization NHs (10 with COVID-19 intensive training, 13 without). NH size, staffing levels, demographics, and comorbidities were largely similar across groups (Table 1). Across the entire 12-month period, the 63 NHs experienced 3,507 staff COVID-19 cases, 4,113 resident COVID-19 cases, and 573 resident COVID-19 deaths (Figure 1).

For staff cases, daily incidence per 100 resident days in the 23 decolonization NHs was 0.19 (NH range = 0–0.61) during baseline and 0.21 (NH range = 0.04–0.52) during the Fall/Winter surge (IRR = 1.51 (95% CI = 1.21–1.88), $P < .001$); for control NHs, 0.11 (NH range = 0–0.37) during baseline and 0.22 (NH range = 0–0.66) during the Fall/Winter surge (IRR = 2.36 (95% CI = 1.99–2.74), $P < .001$). Although cases increased in all NHs during the surge, the 23 decolonization NHs experienced a 36% lesser rise in staff cases (95% CI = 16–51%, $P = .001$) versus control; the decolonization subset without COVID-19 intensive training (N = 13), 42% lesser rise (95% CI = 19–58%, $P = .001$); the decolonization subset with COVID-19 intensive training (N = 10), 28% nonsignificant lesser rise (95% CI = −4 to 50%, $P = .08$). The decolonization subsets both had a baseline COVID-19 staff incidence rate of 0.19, similar to the overall decolonization group.

For resident cases, daily incidence per 100 resident days in decolonization NHs was 0.21 (NH range = 0–0.44) during baseline and 0.21 (NH range = 0–0.61) during the Fall/Winter surge (IRR =1.60 (95% CI = 1.17–2.18), $P = .003$); for control NHs, 0.14 (NH range = 0–0.46) during baseline and 0.22 (NH range = 0–0.73) during the Fall/Winter surge (IRR = 3.04 (95% CI = 2.35–3.95), $P < .001$). Although cases increased in all NHs during the surge, the 23 decolonization NHs experienced a 47% lesser rise in resident cases (95% CI = 23–64%, $P = .001$) versus control; the decolonization subset without COVID-19 intensive training (N = 13), 47% lesser rise (95% CI = 7–70%, $P = .03$); the decolonization subset with COVID-19 intensive training (N = 10), 46% lesser rise (95% CI = 10–67%, $P = .02$). The decolonization subsets both had a baseline COVID-19 resident incidence rate of 0.21, similar to the overall decolonization group.

For resident COVID-19 deaths, the daily rate per 100 resident days in decolonization NHs was 0.026 (NH range = 0–0.13) during baseline and 0.031 (NH range = 0–0.15) during the Fall/Winter surge (IRR = 1.57 (95% CI = 0.93–2.65, $P = .09$); for control NHs, 0.017 (NH range = 0–0.12) during baseline and 0.023 (NH range = 0–0.13) during the Fall/Winter surge (IRR = 1.97 (95% CI = 1.28–3.05, $P = .002$). This difference was not significant between groups (21% (95% CI = −56 to 60%), $P = .50$).

Discussion

It is undisputed that COVID-19 predominantly spreads via the respiratory route. Nevertheless, it is well-described that SARS-CoV-2 and other respiratory viruses can also be transmitted when contacting contaminated secretions, skin, or fomites and subsequently inoculating one's mucus membranes.[5–7] This study suggests that decolonization, which is usually intended to reduce bacterial bioburden and infection, may help disrupt this lesser "touch contact" route of COVID-19 spread. In fact, decolonization mitigated 43% of staff cases and 53% of resident cases, suggesting

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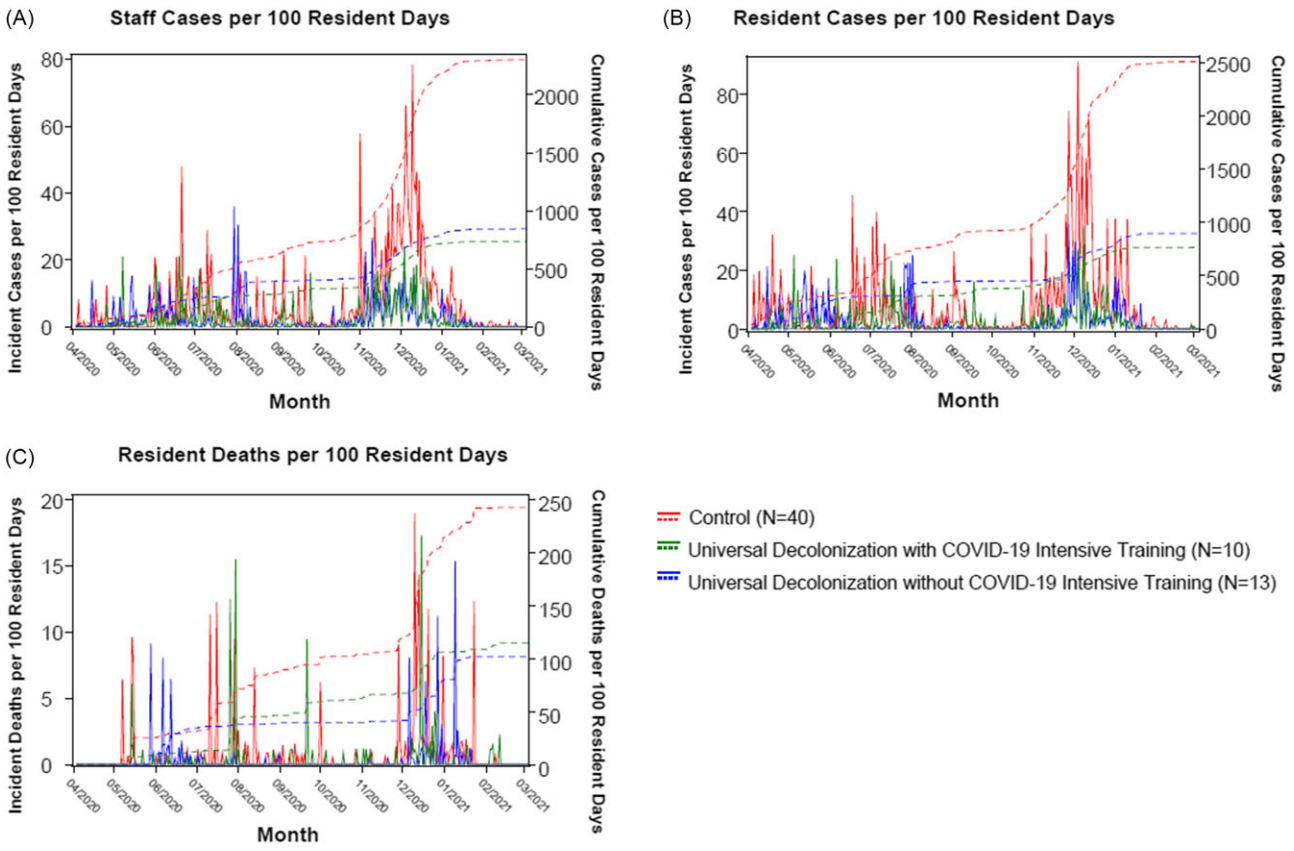

Figure 1. Incident COVID-19 case and death rates among nursing home staff and residents per 100 resident days. Incident (solid lines) and cumulative (dashed lines) COVID-19 cases and deaths for each nursing home were divided by the nursing home's average daily census and multiplied by 100, representing events per 100 resident days, which were aggregated across groups. Nursing homes participating in universal decolonization with COVID-19 intensive training (green line) and universal decolonization without COVID-19 intensive training (blue line) experienced a significant lesser rise in staff and resident COVID-19 cases during the California Fall/Winter surge (October 2020–March 2021) compared to control nursing homes (red line).

that decolonization may have greater-than-anticipated effects on COVID-19 spread in the congregate NH setting.

Chlorhexidine is known to be virucidal. Studies show that oral 0.2% chlorhexidine is effective against SARS-CoV-2, suggesting that 2% bed baths and 4% rinse-off showers would easily remove viral contamination from skin and reduce touch contact sources of transmission.[8,9] This may be particularly important in NHs, where self-care is limited, hands-on caregiving is extensive, and hand hygiene adherence is unfortunately low.[10]

This study has several limitations. First, it uses a quasi-experimental design. Although demographics, comorbidities, and staffing were largely similar across NH groups, volunteerism may reflect improved facility-specific resources and willingness to change practice. Second, decolonization NHs had higher baseline COVID-19 incidence versus control NHs. This higher baseline case rate could confer greater protective immunity during the Fall/Winter surge. Nevertheless, our analyses adjusted for each NH's baseline rate of staff or resident cases. Third, COVID-19 vaccines became widespread during the 2020–2021 Fall/Winter surge, influencing rates of COVID-19 cases and deaths. However, vaccine was prioritized for NHs and the roll out was similar across Orange County. Furthermore, the presence of a control group helps account for unmeasured contextual factors and secular trends.

Our findings highlight the value of decolonization as a strategy with unanticipated potential benefits in reducing touch contact cases of COVID-19 transmission among NH residents and staff.

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