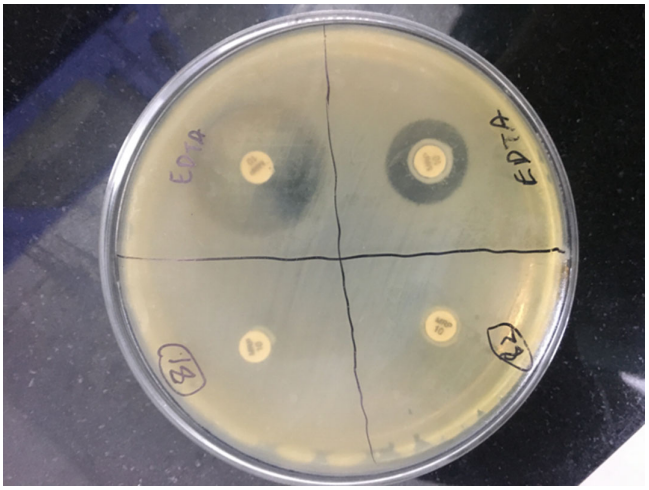

Figure 1.

Table 17: Different CRE infection developed following CRE colonization.

Type of CRE infection developed	*Klebsiella pneumoniae*	*Escherichia coli*	*Enterobacter spp.*
Pneumonia	10	1	1
Surgical site infection	3	4	0
Bloodstream infection	1	0	0
Urinary tract infection	2	2	0
Multiple site infection*	8	1	0

* Includes 6 patients who developed Pneumonia and Surgical site infection, 1 patient each developed Blood stream infection with Pneumonia, Blood stream infection with Surgical site infection and Urinary tract infection with Pneumonia.

Table 18: Characteristics of CRE colonized patients who expired during hospital stay

Feature	*Escherichia coli*	*Klebsiella pneumoniae*	*Enterobacter spp*
Males	2	4	0
Females	0	4	0
Post-surgical patients	0	5	0
No CRE infection	1	0	0
CRE infection developed			
Pneumonia	1	2	0
Surgical site infection	0	1	0
Pneumonia + surgical site infection	0	2	0
Pneumonia + Urinary tract infection	0	1	0
Pneumonia + blood stream infection	0	1	0
Blood stream infection + Surgical site infection	0	1	0

Laboratory Standards Institute 2020 guidelines (Figure 1). **Results:** Among 192 ICU patients, 37 (19.27%) were colonized with CRE (Table 1). Also, 13 (35.13%) CRE isolates showed metallo-β-lactamase resistance. Furthermore, 18 CRE isolates (48.64%) showed serine carbapenemase activity; 6 CRE isolates showed no carbapenemase activity. *Klebsiella pneumoniae* (n = 25 of 37, 67.56%) was the most common CRE isolated followed by *Escherichia coli* (n = 11 of 37, 29.72%) and 1 isolate of *Enterobacter* spp (n = 1 of 37, 0.02%). Of 37 patients, 33 (89.18%) developed CRE infection during their hospital stay. Pneumonia was the most common infection developed (36.36%), followed by surgical site infection (21.21%) and urinary tract infection (12.12%). Only 1 patient developed a bloodstream infection. However, 9 patients (27.27%) developed multiple-site infections. Of 37 CRE-colonized patients, 10 (27.02%) died during their hospital stay. **Conclusions:** Our study highlights the increased risk of CRE infection and mortality in patients with CRE colonization in ICU patients. Hence, CRE perirectal screening for detection of asymptomatic carriers should be conducted, and strict infection control measures, such as isolation and cohorting with barrier nursing of such patients, should be done to prevent further spread of CREs in hospital settings.

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Presentation Type:
Poster Presentation
Subject Category: Infection Prevention

Medical Tape Contamination Study: Effect of Packaging on the Reduction of Cross Contamination

Kheng Vang; Graham Smith and Sara J Pastoor

Background: Medical tape is used routinely for a variety of tasks across healthcare settings. The literature contains numerous publications in which common practices around medical tapes have been suspected to lead to infection transmission. Healthcare providers can turn to individually packaged single-patient-use medical tape rolls to help reduce cross-contamination risk by limiting exposure to environmental contaminants, minimizing contact with hospital surfaces and equipment, and minimizing exposure to healthcare workers' hands and other patients. **Methods:** We evaluated the effect of individually packaged tape on cross contamination using a controlled laboratory assay. Ceramic tiles were inoculated with microorganisms evenly spread across the surface and allowed to air dry. Using gloves, packaged and unpackaged tapes were rolled over their entire outside circumference onto the contaminated tiles to simulate cross contamination. Using new gloves, the packaged tapes were then removed from their package with minimum contact. All cross-contaminated tape rolls were placed in phosphate-buffered water and mixed in a vortexer for bacterial recovery procedures. Serial dilutions were plated on appropriate media for bacterial enumeration. The average log10 colony-forming unit (CFU) recovery was measured for comparison. We used 4 types of tapes in this study (3M Micropore S Surgical Tape, 3M Medipore H Soft Cloth Surgical Tape, 3M Durapore Surgical Tape, and 3M Transpore White Surgical Tape). We used 4 different microorganisms as inoculates: *Staphylococcus aureus* (methicillin-resistant), *Enterococcus faecium* (vancomycin-resistant), *Klebsiella pneumoniae*

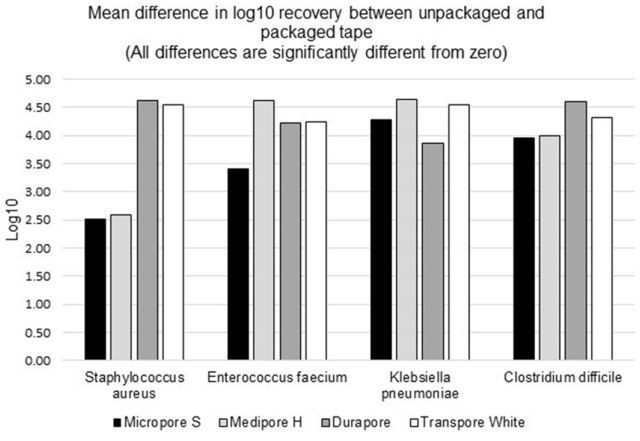

Figure 1.

(carbapenem-resistant), and *Clostridium difficile* (spore). Each test (tape and bacteria combination) was done in 3 or 6 replicates; each bacterial enumeration was the average of duplicate plates. The detection limit for this method is 8 CFU per sample, which is equivalent to 0.9 log10. **Results:** The results for all tapes tested showed a statistically significant lower mean log10 recovery of each of the microorganisms tested for packaged versus unpackaged tape (Figure 1). The mean differences of log10 recoveries from a packaged and unpackaged tape ranged from 2.51 log10 (for *S. aureus* on Micropore S) to 4.64 log10 (for *K. pneumoniae* on Medipore H). This is equivalent to 99%–99.99% cross-contamination protection from the 4 organisms tested. **Conclusions:** Individual packaging of medical tape rolls protects them from external contaminants. Even if the packaging becomes contaminated, the tape retrieved from the package will be significantly less contaminated than it would have been from exposure to the same contaminants without packaging.

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Subject Category: Long-Term Care

Nursing-Home Patient Functional and Microbiota Status Drive Environmental Contamination with Vancomycin-Resistant Enterococci

Joyce Wang; Betsy Foxman; A. Krishna Rao; Lona Mody and Evan Snitkin

Background: Patient colonization and shedding of vancomycin-resistant enterococci (VRE) is a major source of environmental contamination leading to VRE transmission in nursing homes. We hypothesize that we can inform mitigation strategies by identifying patient clinical and microbiota features associated with environmental contamination with VRE. **Methods:** During a 6-month period of active surveillance in 6 Michigan nursing homes, 245 patients (with 806 follow-up visits) were enrolled. Patient clinical data and swabs for VRE were collected from multiple body sites and high-touch environmental surfaces. In total, 316 perirectal swabs were collected from 137 patients for gut microbiota analysis and community status type (CST) assignment based on taxonomic composition. The associations between VRE colonization pattern, gut microbial CST, and patient factors were examined using multivariable generalized estimating equations, adjusting for patient-and facility-level clustering. We used VRE colonization patterns to group study visits: "uncolonized" (patient−/environment−); "environment-only" (patient−/environment+); "patient-only" (patient+/environment−); "both" (patient+/environment+). **Results:** Across all study visits, VRE colonization on patient hand and groin/perirectal area was positively correlated with VRE contamination of high-touch environmental surfaces, suggesting direct transfer of VRE between patient and environment via patient hands (Figure 1A). We next set out to identify patient factors associated with patient colonization and environmental contamination. At baseline, while patients in the "both" group had anticipated risk factors such as longer prior hospitalization and more frequent broad-spectrum antibiotic use, they were unexpectedly younger than "uncolonized" patients and had similar functional status. This last feature contrasted with the "patient-only" group, characterized by higher urinary catheter use and higher functional dependence, suggestive of lower functional dependence facilitating patient contamination of their environment. No clinical features distinguished "uncolonized" and "environment-only" patients (Table 1). Lastly, in multivariable analyses, we determined the contribution of patient functional status and gut microbiota features to environmental contamination. Low-diversity CST, characterized by reduced anaerobic taxa, was weakly associated with "patient-only" and significantly associated with "both." Notably, high functional dependence was significantly associated with "environment-only" and "patient-only" but not "both," indicating high-functioning patients with disrupted gut microbiota as drivers of environmental contamination (Figure 1B). **Conclusions:** Our findings suggest that antimicrobial exposure disrupts patient gut microbiota, a significant mediator of colonization dynamics between patients and their environment, and that high-functioning patients may be more likely to spread VRE between their body sites and high-touch environmental surfaces (Figure 2). These findings highlight both antibiotic stewardship and patient hand hygiene as important targets for interrupting transmission mediated by environmental contamination.

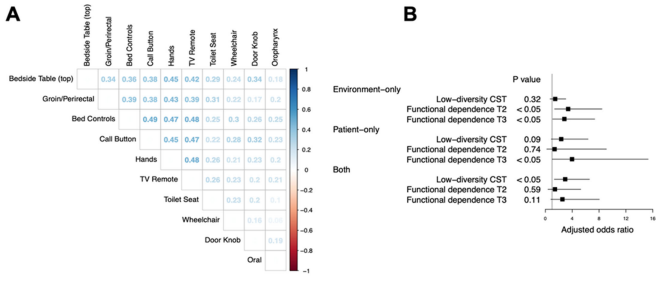

Figure 1 A) Hand and groin colonization with vancomycin-resistant enterococci (VRE) colonization are positively correlated with contamination of high-touch environmental surfaces (Cohen's Kappa statistic). A coefficient of 1 indicates positive correlation and -1 indicates negative correlation. A coefficient less than 0.2 suggests slight agreement; if 0.2–0.4, "fair agreement", if 0.4–0.6, "moderate agreement". **B)** Odds ratio of VRE colonization pattern by functional and gut microbiota status, adjusted for facility and patient-level clustering, and risk factors significantly associated with colonization pattern in univariate analysis (P < .05). Functional dependence was measured by physical self-maintenance score, ranging from 6 (full independence) to 30 (full dependence) in 6 categories of self-maintenance (bathing, dressing, feeding, ambulation, grooming, and toileting), log10 transformed and discretized into tertiles. T1 corresponds to the lowest tertile and lowest dependence, and T3 corresponds to the highest tertile and highest dependence. *0.1, **0.05, ***0.01.

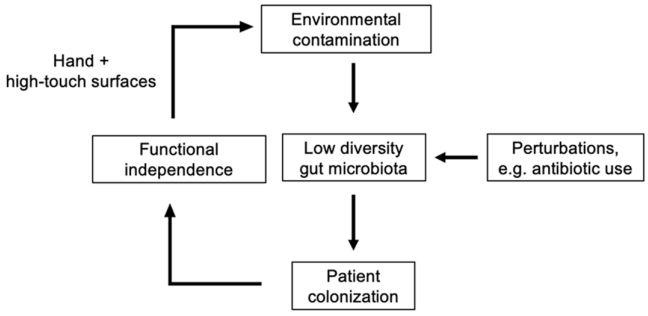

Figure 2. Conceptual model depicting the spread of VRE between environmental and patient sites. Upon exposure to VRE in the environment, patients with high-diversity microbiota are able to resist VRE colonization. However, those with low-diversity microbiota due to perturbations such as antibiotic use are susceptible to VRE colonization in the gut. While low-functioning patients are less likely to interact with their immediate environment, high-functioning patients interact with high-touch surfaces and further propagate environmental contamination.

	No VRE colonization (N = 163)	Environmental (N = 32)	Patient (N = 13)	Both (N = 36)
Age (mean, SD)	73.4 (14)	72 (12.2)	73.2 (14.8)	68 (11.9)**
Male sex (%)	69 (42.3)	17 (53.1)	5 (38.5)	19 (52.8)
Charlson score (mean, SD)	0.5 (0.3)	0.5 (0.3)	0.5 (0.2)	0.5 (0.2)
Urinary catheter (%)	32 (20.4)	8 (25.8)	6 (50)**	6 (17.6)
Hospital stay (SD)	0.8 (0.3)	0.9 (0.3)	0.9 (0.3)	1 (0.2)***
Exposure to narrow-spectrum antibiotic within past 30 days (%)	28 (23.7)	6 (31.6)	2 (28.6)	4 (33.3)
Exposure to broad-spectrum antibiotic within past 30 days (%)	45 (33.3)	13 (50)	6 (54.5)	24 (75)***
Functional dependence T1 (%)	54 (33.1)	8 (25)	1 (7.7)*	9 (25)
Functional dependence T2 (%)	52 (31.9)	11 (34.4)	4 (30.8)	16 (44.4)
Functional dependence T3 (%)	54 (33.1)	13 (40.6)	8 (61.5)*	11 (30.6)

Table 1: Patient characteristics at enrollment and unadjusted univariate analysis, stratified by VRE colonization status. VRE, vancomycin-resistant enterococci. SD, standard deviation. Charlson comorbidity score and length of hospital stay were log transformed. Functional dependence was measured by physical self-maintenance score, ranging from 6 (full independence) to 30 (full dependence) in 6 categories of self-maintenance (bathing, dressing, feeding, ambulation, grooming, and toileting), log10 transformed and discretized into tertiles. T1 corresponds to the lowest tertile and lowest dependence, and T3 corresponds to the highest tertile and highest dependence. *0.1, **0.05, ***0.01.

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