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Poster Presentation

Novel Method to Detect Cardiac Device Infections by Integrating Electronic Medical Record Text with Structured Data in the Veterans Affairs Health System

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Background: Cardiovascular implantable electronic device (CIED) infections are highly morbid, yet infection control resources dedicated to preventing them are limited. Infection surveillance in outpatient care is also challenging because there are no infection reporting mandates, and monitoring patients after discharge is difficult. **Objective:** Thus, we sought to develop a replicable electronic infection detection methodology that integrates text mining with structured data to expand surveillance to outpatient settings. **Methods:** Our methodology was developed to detect 90-day CIED infections. We tested an algorithm to accurately flag only cases with a true CIED-related infection using diagnostic and therapeutic data derived from the Veterans Affairs (VA) electronic medical record (EMR), including administrative data fields (visit and hospital stay dates, diagnoses, procedure codes), structured data fields (laboratory microbiology orders and results, pharmacy orders and dispensed name, quantity and fill dates, vital signs), and text files (clinical notes organized by date and type containing unstructured text). We evenly divided a national dataset of CIED procedures from 2016–2017 to create development and validation samples. We iteratively tested various infection flag types to estimate a model predicting a high likelihood of a true infection, defined using chart review, to test criterion validity. We then applied the model to the validation data and reviewed cases with high and low likelihood of infection to assess performance. **Results:** The algorithm development sample included 9,606 CIED procedures in 67 VA hospitals. Iterative testing over 381 chart reviewed cases with 47 infections produced a final model with a C-statistic of 0.95 (Table 1). We applied the model to the 9,606 CIED procedures in our validation sample and found 100 infections of the 245 cases identified by the model to have a high likelihood of infection We identified no infections among cases the model as having low likelihood. The final model included congestive heart failure and coagulopathy as comorbidities, surgical site infection diagnosis, a blood or cardiac microbiology order, and keyword hits for infection diagnosis and history of infection from clinical notes. **Conclusions:** Evolution of infection prevention programs to include ambulatory and procedural areas is crucial as healthcare delivery is increasingly provided outside traditional settings. Our method of algorithm development and validation for outpatient healthcare-associated infections using EMR-derived data, including text-note searching, has broad application beyond CIED infections. Furthermore, as integrated healthcare systems employ EMRs in more outpatient settings, this approach to infection surveillance could be replicated in non-VA care.

Table 1. CIED Infection Detection Algorithm Logistic Regression Results for Development and Validation in 2016-2017 VA Data

	Development Sample (n=381 CIED procedures, 47 infections)	Validation Sample (n=295 CIED procedures, 100 infections)
Variables	OR (95%CI)	OR (95%CI)
Comorbidity		
Congestive heart failure	**0.12 (0.04-0.39)**	**0.52 (0.23-1.21)**
Coagulopathy	**7.76 (1.94-30.93)**	**0.74 (0.23-2.39)**
Pulmonary circulation disease		
Billing Data		
Emergent problem		
ICD10 code for SSI only	**12.09 (3.47-42.1)**	**24.63 (8.88-68.31)**
Pharmacy Data		
No Abx ≥ 3 days		
Abx ≥ 3 days to treat staph		
Abx ≥ 3 days – not related to staph		
Laboratory Data		
No Micro order	ref	ref
Micro order - Blood	**6.35 (1.85-21.77)**	1 (0.28-3.53)
Micro order - Cardiac	**5.7 (1.71-19.05)**	1.72 (0.79-3.74)
Misc Micro order	0.56 (0.05-6.47)	ERR
Text Note Data		
Diagnosis of infection	**25.99 (3.14-215.49)**	**7.63 (2.25-25.84)**
History of infection	**0.09 (0.02-0.32)**	**0.05 (0.02-0.15)**
Model c- statistic	0.96	0.90

ERR=error in model because there were too few cases with a misc micro order in our validation chart review sample.

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Novel Method to Evaluate Diagnostic Shifting After a Pediatric Antibiotic Stewardship Intervention

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Background: Audit-and-feedback interventions track clinician practice patterns for a targeted practice behavior. Audit and feedback of antibiotic prescribing data for acute respiratory infections (ARI) is an effective stewardship strategy that relies on administrative coding to identify eligible visits for audit. “Diagnostic shifting” is the misclassification of a patient’s diagnosis in response to audit and feedback and is a potential unintended consequence of audit and feedback. Objective: To develop a method to identify patterns consistent with diagnostic shifting including both positive shifting (improved diagnosis and documentation) and negative shifting (intentionally altering documentation of diagnosis to justify antibiotic prescribing), after implementation of an audit-and-feedback intervention to improve ARI management. **Methods:** We evaluated the intervention effect on diagnostic shifting within 12 University of Utah pediatric clinics (293 providers). Data included 66,827 ARI diagnoses: pneumonia, sinusitis, bronchitis, pharyngitis, upper respiratory infection (URI), acute otitis media (AOM), or serous otitis with effusion (OME). To determine whether rates of ARI diagnoses changed after the intervention, we developed logistic generalized estimating equation (GEE) models with robust sandwich standard error estimates to account for clinic-wise clustering. Outcomes included the change in each ARI diagnosis relative to the competing 6 diagnoses included in audit-and-feedback reports before and after intervention implementation. Models tested for a change in outcomes after the intervention (ie, diagnostic shift) after adjustment for month of diagnosis. For each diagnosis, we estimated the population attributable fraction (PAF) for antibiotic prescriptions due to combined shifts in

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Population Attributable Fraction (PAF) of Antibiotics Among Patients with a Respiratory Diagnosis.

	Pre Intervention		Post Intervention		
	Probability of Diagnosis	For a given diagnosis, Probability of Receiving Antibiotic	Probability of Diagnosis	For a given diagnosis, Probability of Receiving Antibiotic	PAF
Sinusitis	2.36%	92.04%	1.08%	97.01%	2.76%
Bronchitis	9.03%	15.47%	7.25%	16.98%	0.41%
Pharyngitis	12.02%	50.21%	11.73%	44.69%	1.95%
URI	49.56%	17.04%	51.36%	9.43%	8.87%
AOM	19.41%	83.90%	18.29%	81.12%	3.56%
OME	9.70%	60.57%	11.02%	45.11%	2.23%
Pneumonia	0.61%	69.37%	0.31%	83.38%	0.41%

diagnostic frequencies and prescription rates for each diagnosis. The PAF is the estimated fraction of antibiotic prescriptions that would have changed under a population-level intervention. **Results:** In month-adjusted analyses, diagnoses of pneumonia and OME decreased after the intervention: odds ratio (OR), 0.46 (95% CI, 0.31–0.68) and OR, 0.81 (95% CI, 0.67–0.99), respectively. In addition, URI diagnoses increased: OR, 1.05 (95% CI 1.00, 1.11). We did not detect changes in the diagnosis rates of sinusitis, AOM, bronchitis, and pharyngitis post intervention. The intervention effect on the PAF for antibiotics prescriptions was consistently positive but relatively small in magnitude. PAF was highest for URIs (PAF, 8.87%), followed by AOM (PAF, 3.56%) and sinusitis (PAF, 2.76%), and was lowest for pneumonia and bronchitis (PAF, 0.41% for both). **Conclusions:** Our analysis found minimal evidence overall of diagnostic shifting after a stewardship intervention using audit and feedback in these pediatric clinics. Small changes in diagnostic coding may reflect more appropriate diagnosis and coding, a positive effect of audit and feedback, rather than intentional negative diagnostic shift.

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Observational Bias Within Hospital-Wide Hand Hygiene Program

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Background: Hand hygiene (HH) is critical to prevent hospital-acquired infections. Running a successful HH program requires valid and accurate HH data to monitor the status and progress of HH improvement efforts. HH data are frequently subject to variable forms of bias, for which considerations must be made to enhance the validity of HH data. **Objective:** We assessed the extent to which observers may be prone to report more favorable HH rates when observing healthcare workers from the same professional group versus members of other job categories. **Methods:** We analyzed HH data from 48,543 electronically collected observations conducted by frontline healthcare workers in a 793-bed acute-care hospital from January 1, 2019, through July 31, 2019. All auditors received training on HH observations and proper use of the data collection application. Compliance data were sorted into peer versus nonpeer observations by profession. We compared HH compliance rates for members of each professional group when monitoring peers versus nonpeers. We further stratified results by ancillary professions (central transport, unit associates, food services, pharmacy, phlebotomy, rehabilitation services, and respiratory therapy) versus nonancillary professions (doctors, nurses, physician assistants, patient care assistants). **Results:** Of 12,488 ancillary observations, 7,184 (57.5%) were peer observations and 36,055 were nonancillary observations, of which 15,942 (44.2%) were peer observations. The percentage of peer-to-peer observations versus nonpeer observations varied by profession, ranging from 96% of central transport workers and 91% of environmental services observations to 21% of patient care assistants and 34% of physician's assistants. Average compliance rates for peer versus nonpeer observations in ancillary groups were 98% (95% CI, 98.7%–99.2%) versus 83% (95% CI, 82.5%–84.5%). Average compliance rates nonancillary groups were 92% (95% CI, 92.0%–92.8%) for peers versus 88% (95% CI, 87.8%–88.7%) for nonpeers (Table 1).

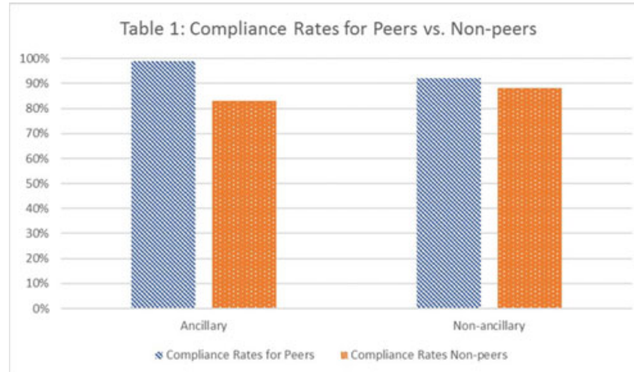

Fig. 1.

Conclusions: We documented a propensity for some categories of healthcare workers to record discrepant rates of HH compliance when observing members of the same peer group versus others. This effect was more pronounced amongst ancillary versus nonancillary services. This study adds to the literature of potential sources of bias in HH monitoring programs. Operational changes in HH program data collection may be warranted to try to mitigate these biases such as increasing the frequency of validation exercises conducted by nonaffiliated observers, weighting peer versus nonpeer observations differently, or switching to automated electronic monitoring systems.

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Occupational Exposure to Varicella Zoster in a Tertiary-Care Healthcare Setting

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Background: Disseminated varicella zoster virus (dVZV) infection is a feared complication of varicella zoster virus (VZV) reactivation in immunocompromised patients. The CDC recommends contact and airborne precautions for localized VZV in immunocompromised patients until dissemination has been ruled out. Pre-emptive isolation can be problematic for medical centers without access to negative-pressure rooms. When we identify a case of dVZV at our facility, we perform an investigation to identify occupational exposures. **Methods:** We conducted a retrospective, descriptive review of occupational exposure investigations related to dVZV from

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