(OR) of 1.66 (95% CI, 1.50–1.84; $P < .001$). HH compliance improved across all HCW roles: (1) physician compliance improved from 55% to 67% (OR, 1.69; 95% CI, 1.42–2.01; $P < .001$); (2) nurse compliance from 61% to 73% (OR, 1.68; 95% CI, 1.46–1.93; $P < .001$); and (3) other HCW compliance from 52% to 62% (OR, 1.48; 95% CI, 1.10–1.99; $P = .010$). **Conclusion:** CUSP was successfully adapted by 4 diverse tertiary-care NICUs in Pune, India, and it resulted in increased HH compliance at all sites. This multimodal strategy is a promising framework for LMIC healthcare facilities to sustainably address IPC gaps and reduce HAI and mortality in neonates.

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Presentation Type:
Distinguished Oral

Increase in Surgical Site Infections Caused by Gram-Negative Pathogens in Warmer Weathers Data From More Than 2 Million Surgeries

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Background: Various studies have linked periods of warmer temperatures to an increased occurrence of surgical site infections (SSIs) and healthcare-associated infections in general. In an observational study, we sought to determine the pathogens for which this association was especially strong. **Method:** Patient- and procedure-related data of the SSI-module of the German nosocomial infection surveillance system were linked with monthly aggregated meteorological data from the German Meteorological Service for a period from 2000 to 2016. Due to high correlation with other meteorological parameters, analyses were executed focusing on the outside ambient temperature. Temperature was regarded as both a continuous variable and a categorical variable with different temperature intervals (5°C steps ranging from <5°C to ≥20°C). Through multivariable logistic regression analysis, adjusted odds ratios (OR) with 95% confidence intervals were calculated for SSI rates relating to temperature. SSIs were stratified by pathogen and depth of infiltration. **Result:** Altogether, 2,004,793 procedures, conducted in 1,455 German surgical departments and resulting in 32,118 SSIs, were included. A general association of warmer mean temperatures in the month of surgery with an increased SSI-risk was observed, particularly for SSIs caused by gram-negative pathogens. Stratification by pathogen revealed that the association was especially prominent for *Acinetobacter* spp, *Pseudomonas aeruginosa*, and certain *Enterobacteriaceae*. Per additional 1°C, we observed a 6% increase in the risk for SSIs caused by *Acinetobacter* spp (OR, 1.06; 95% CI, 1.04–1.09), and a 4% increase in the risk for SSIs caused by *Enterobacter* spp (OR, 1.04; 95% CI, 1.03–1.05). Among gram-positive pathogens, temperature-association was strongest for *Staphylococcus aureus*. Superficial SSIs showed a higher temperature-association than deeper SSIs. The risk for superficial SSIs with *Acinetobacter* spp significantly increased >10-fold after surgeries conducted in months with a mean temperature of ≥20° C in reference to <5°C. For *Pseudomonas aeruginosa*, we observed a >2-fold statistically significant increase in the risk for superficial SSIs, when comparing the same temperature categories (≥20°C vs <5°C). **Conclusions:** Our study demonstrated that higher temperatures were associated with increased SSI-rates caused by gram-negative bacteria. As a consequence, future SSI-prevention measures should place a higher emphasis on the parameter season as part of a more tailormade, personalized approach at infection prevention. For instance, it may be conceivable to seasonally adjust decolonizing regimes and certain prophylaxes. Underlying shifts in microbiome composition due to meteorological factors should be considered in further analyses. Given the expected rise of global temperatures until the end of the century, the topic gains relevance from multiple perspectives.

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Investigation of Events Related to Laboratory-Confirmed Contamination of Pharmaceutical Products: Summary of CDC Consultation

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Background: Contaminated pharmaceutical products pose serious infection risks to patients and can lead to significant morbidity and mortality. Contamination at the point of manufacturing or compounding (intrinsic contamination) has the potential to affect large numbers of patients. Public health plays a critical role in detecting and investigating such events. We identified investigations involving intrinsically contaminated pharmaceuticals to characterize the burden and scope of harm associated with these events. **Methods:** We reviewed Centers for Disease Control and Prevention records to identify US investigations between January 1, 2009, and December 31, 2018, involving laboratory-confirmed contamination of manufactured medications and pharmacy-compounded preparations (P-CPs), using relevant search terms (eg, "medication contamination"). Laboratory confirmation was defined as identification of a pathogen from a manufactured medication or P-CP. We determined the number and type of patient infections associated with these investigations, the number of states involved, pathogens identified, type of medication (sterile or nonsterile), route of administration, and how the contamination event was first identified. We excluded investigations when the mode of production was unknown. **Results:** We identified 20 investigations in at least 20 states involving laboratory-confirmed contamination of manufactured medications (n = 12) and P-CPs (n = 8). Patient infections were identified in 16 (80%) investigations (9 involving manufactured medications and 7 involving P-CPs) resulting in at least 1,183 infections and at least 73 deaths. Bloodstream infections were the most common infection type (n = 7, 44%). Waterborne pathogens (eg, *Serratia marcescens*, *Burkholderia*

cepacia) were cultured from medications in 83% (n = 10) of investigations involving manufactured medications and 75% (n = 6) of investigations involving P-CPs. Contamination of sterile pharmaceutical products occurred in 14 (70%) investigations; 11 (79%) of these involved injectables. Information regarding how contaminated pharmaceuticals were first identified was documented for 18 investigations; most cases (n = 14, 78%) started with investigation of patient infections by facilities, public health, or both, which led to laboratory testing of pharmaceuticals and confirmation of contamination. **Conclusions:** The events summarized here likely underestimate the frequency of intrinsic contamination of pharmaceutical products in the United States. These events can have devastating consequences that impact patients across the country. Waterborne pathogens appear to be the most frequently identified source of contamination in both manufactured medications and P-CPs.

Detection, investigation, control, and prevention of pharmaceutical contamination events benefit from collaboration between state and federal public health authorities; without public health intervention. Such contamination may have gone undetected and could have harmed additional patients.

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Distinguished Oral

Large Multisite Clinical Field Study Characterizing Contamination Levels in Patient Used Endoscopes After Manual Cleaning

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Background: Multiple outbreaks multidrug-resistant organisms (MDROs) have been associated with flexible endoscopes resulting in unacceptable patient mortality and morbidity. Evidence highlights the importance of effective cleaning to achieve effective high-level disinfection (HLD). This study presents an analysis of >700,000 measurements of adenosine-triphosphate (ATP) contamination levels found in flexible endoscopes after manual cleaning. **Method:** This 2018–2019 study consists of 702,768 measurements of ATP levels found in the suction/biopsy channel of instruments used on patients after manual cleaning: gastroscopes (267,533 measurements from 223 sites), duodenoscopes (123,697 measurements from 161 sites), colonoscopes (252,249 measurements from 229 sites), and bronchoscopes (59,289 measurements from 107 sites). Sites were located across the United States and employed protocols that included routine cleaning verification performed by the reprocessing technicians using a handheld luminometer and the associated ATP water test (3M Clean-Trace). **Results:** Figure 1 shows a boxplot analysis of the ATP levels by endoscope type. Upper gastrointestinal (GI) endoscopes (gastroscopes and duodenoscopes) show a significantly ($P < .005$) greater level of ATP contamination after manual cleaning. The pairwise mean differences are all significant ($P < .005$) except for colonoscopes when compared to bronchoscopes ($P = .203$). Also shown on Fig. 1 is a literature supported adequate cleanliness value of 200 RLUs [=2.3log(RLUs)] (MJ Alfa et al.; *Am J Infec Control* 2013;41:245–253 and ANSI/AAMI ST91; 2015). A 95% confidence interval analysis performed against this literature value (Table 1) showed that a high number of gastroscopes (12%) and

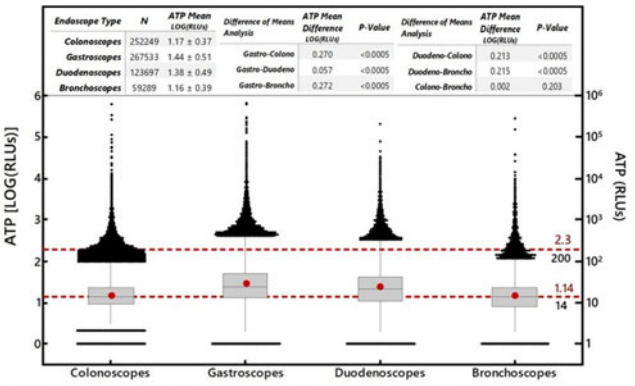

Figure 1 –Boxplot analysis showing a comparison of the results by endoscope type (Q1-Q3 interquartile box range with median line and mean values shown as closed red circles, including whiskers to 1.5 times the box height and outliers shown as closed black circles. The red dotted line at 1.14LOG(RLUs) or 14RLUs represents the mean background value of the method)

Fig. 1.

Table 1- Results for Tolerance Interval Analysis (95% Tolerance Interval)

Endoscope Type	% Sample Population Above 200RLUs [2.3 LOG(RLUs)]	Achieved Confidence (%)
Colonoscopes	2	95
Gastroscopes	12	95
Duodenoscopes	10	95.1
Bronchoscopes	3	95

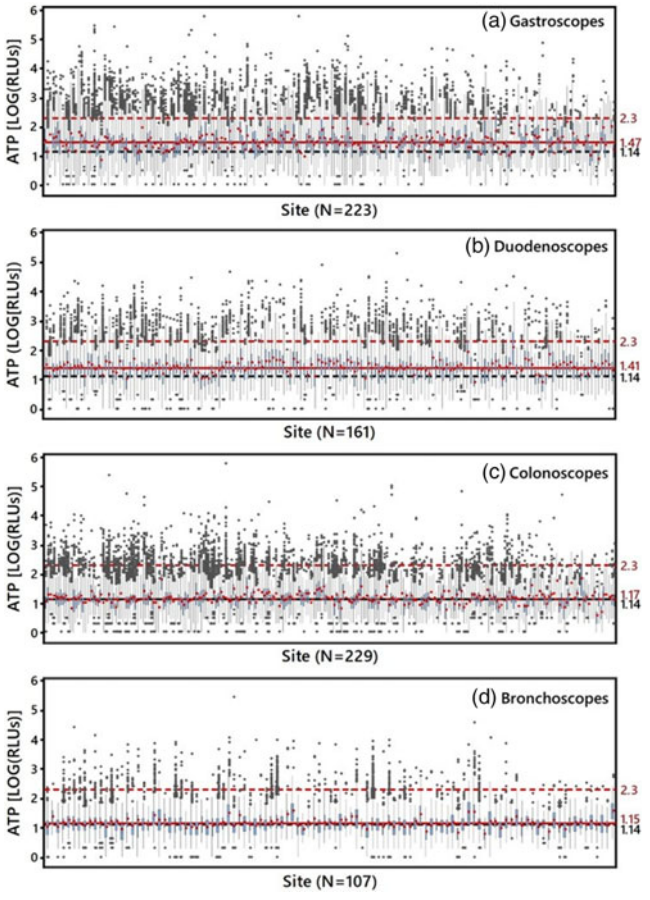

Fig. 2.