

come equipped or are retrofitted with the most current safety equipment since rollover deaths have been documented since the 1920s [7]. Finally, training and information for ED doctors, first responders, and other care givers about the hazards and possible outcomes of tractor injuries, especially in rural healthcare systems, could lead to faster response times and more comprehensive care [7].

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Refining reflex urine culture testing in the ED



Screening for urinary tract infections is often performed by urinalysis (UA) which measures specific urine elements such as nitrites, white blood cells (WBC), and leukocyte esterase (LE). In our Emergency Department (ED), a positive UA, defined as positive nitrite, or >3 WBC, or positive LE, will automatically generate a urine culture to identify and quantify bacteriuria for specimens ordered as a UA with reflex to culture. Our institution's policy is that antibiotic treatment will be provided for patients with urine culture results yielding 60,000 colony-forming units (cfu) per milliliter (ml). Culture results of $\geq 60,000$ cfu per ml are reviewed by an ED physician to determine the course of action and treatment. Although treatment is based on chart review, there is inclination to treat positive UA and culture results $\geq 60,000$ cfu per ml. The Infectious Disease Society of America states there is no measureable benefit to screen for asymptomatic bacteriuria for most adults

>18 years of age, unless atypical symptoms or patient characteristics are present [1–4].

UA with reflex to culture is a common laboratory order that was initially designed to reduce the number of urine cultures and antibiotic treatment for patients with negative UA results [5–7]. However, reflexing specimens to urine culture based on positive UA does not include indications for UTI in the reflex algorithm [8,9]. Urine cultures ordered without clinical indication can lead to inappropriate antimicrobial treatment [10–14]. It is recommended that EDs examine automatic reflexes to culture based on UA results [15].

In an urban tertiary care hospital in Illinois, USA from January 2016–December 2016, 23,722 UA specimens from the ED were ordered as a UA with reflex to culture. Of the 23,722 specimens, 8721 were cultured, 2701/8721 (31%) were positive, defined as bacteriuria $\geq 60,000$ cfu per mL or positive for yeast, and 6020/8721 (69%) were negative, defined as no growth or non-diagnostic growth (<60,000 cfu per ml).

This project was approved by the local institutional review board as non-human subjects research. Through cause mapping, the project team discovered that 1) the high number of negative urine cultures was linked to UA with reflex to culture being ordered without an indication, 2) UA with reflex to culture was pre-checked in several ED order sets, and 3) reflex to culture thresholds were less sensitive compared to other institutions. Additionally, not all physicians were clear on guidelines of when it was appropriate to order a UA with reflex to culture in the ED.

Based on completion of an impact to effort matrix and failure modes and effects analysis, the project team decided to update the ED abdominal pain and psychiatric pre-checked order sets, which had the highest negative urine culture rate, from pre-checked UA with reflex to culture to pre-checked UA, with urine culture available but unchecked. Education on when to screen for and treat a UTI, based on Infectious Disease Society of America guidelines, was provided at Emergency Medicine department meetings to ED attending physicians, administration and leadership, and midlevel providers [1–4]. A hardcopy of the information was given to attendees and an email was sent to all ED providers. The reflex to culture threshold was changed from >3 WBC to >4 WBC. UA specimens positive for nitrite or LE continued to reflex to urine culture. By incorporating the changes into the process of ordering urine cultures, the team believed the results would be sustainable long-term.

Data was analyzed 5 months pre- and post-intervention. All statistics were performed in Minitab Statistical Software Version 18.1. A p -value of <0.05 was considered significant. The number of UA with reflex to culture orders per day was reduced from 92 orders per day to 49 orders per day (mean) post-intervention (t -test, $p < 0.001$) (Fig. 1A). The number of UA orders per day without reflex was significantly increased from 3 orders per day to 41 orders per day (median) post-intervention (Mann-Whitney U Test, $p < 0.001$) (Fig. 1B). The number of negative urine cultures per day was significantly reduced from 13 cultures per day to 6 cultures per day (median), a 54% reduction in negative urine cultures post-intervention with an estimated cost savings of \$71,350 per year based on direct costs of urine cultures (Mann-Whitney U Test, $p < 0.001$) (Fig. 2).

ED patient volumes remained stable throughout the pre- and post-intervention time periods. There were no significant changes in the number of 72-hour returns to the ED and 30-day readmissions with diagnosis of UTI, sepsis, bacteremia, or pyelonephritis post-intervention (Fig. 3A–B).

Providing education on when it is appropriate to screen for and treat a UTI, updating pre-checked order sets, and increasing reflex to culture thresholds led to a decreased number of negative urine cultures, reducing the high cost of quality waste from inappropriate urine culture testing in the ED. There is substantial opportunity for decreasing costs and

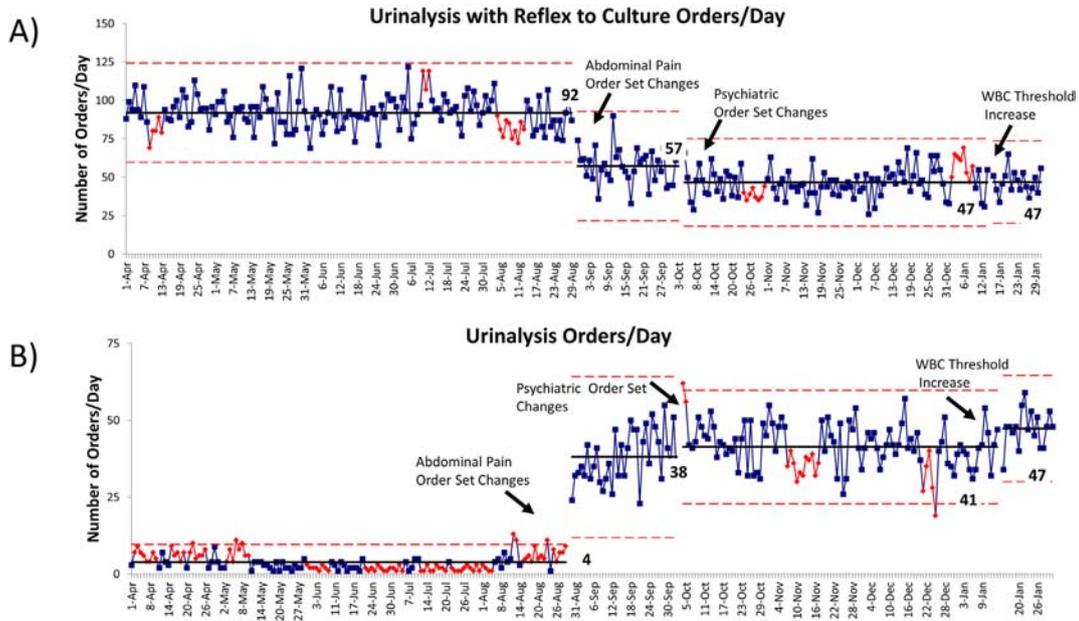


Fig. 1. Following education and updating the pre-checked order sets, the number of urinalysis with reflex to culture orders per day was significantly reduced (*t*-test, $p < 0.001$) (A) and the number of urinalysis orders per day was significantly increased (Mann-Whitney *U* test, $p < 0.001$) (B).

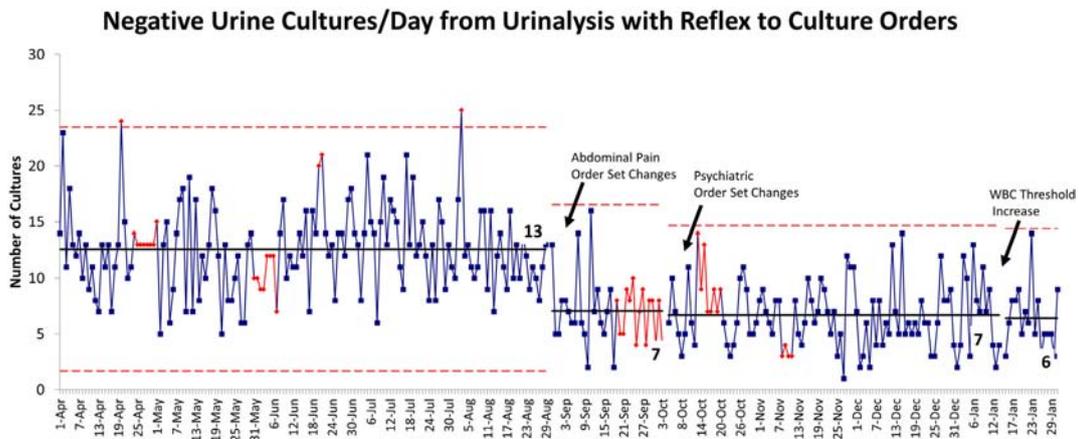


Fig. 2. Following education, updating pre-checked order sets, and increasing the urinalysis with reflex to culture threshold, the number of negative urine cultures was significantly reduced (Mann-Whitney *U* Test, $p < 0.001$).

improving antimicrobial stewardship by addressing automatically reflexing UA results to culture.

Declarations of interest

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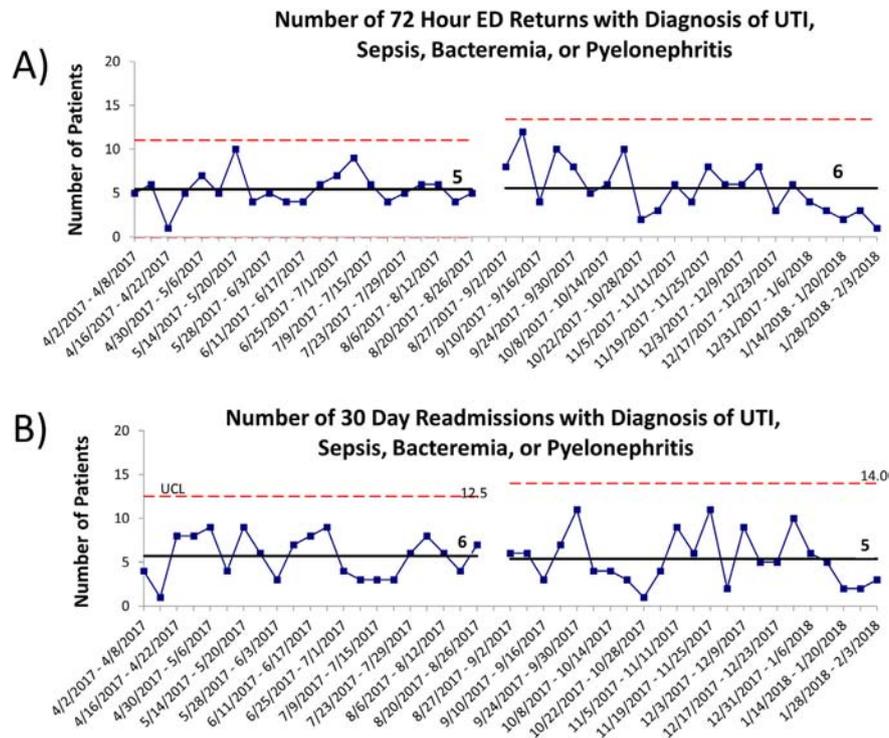


Fig. 3. The number of 72-hour Emergency Department returns per week (A) (Mann-Whitney U test, $p = 0.915$) and 30-day readmissions per week (B) (t -test, $p = 0.694$) with diagnosis of urinary tract infection (UTI), sepsis, bacteremia, or pyelonephritis was not significantly altered post-intervention.

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Emergency department visits for chemical substance-related injuries



The increasing use of chemicals worldwide has led to an increase in the incidence of chemical accidents [1]. Acute exposure to chemicals can be fatal and usually necessitates emergency treatment [2,3]. Although large- and small-scale chemical accidents frequently occur [4], studies on human injuries from chemical exposure are limited, including the population who are usually exposed to harmful chemicals. Hence, this study aimed to analyze the types and characteristics of chemical injuries by analyzing patients who visited university hospitals due to acute exposure to chemical substances.

This study enrolled patients unintentionally injured by acute exposure to chemical substances among those who visited the emergency departments of Soonchunhyang University Gumi Hospital and Ulsan University Hospital in South Korea between January 2007 and December 2016. Both Gumi and Ulsan have high distribution of chemical use and high density of industrial complexes. Medical records were retrospectively reviewed to collect data on sex, age, body areas exposed to the chemical, exposure mechanisms, diagnosis, disposition, and kinds and types of the chemical substances.

A total of 828 patients were included in the cohort. Of these, 708 (85.5%) were men, and 120 (14.5%) were women. The mean patient