The Effect of a Hospital-Wide Urine Culture Screening Intervention On the Incidence of Extended Spectrum Beta-Lactamase (ESBL)-Producing *Escherichia coli* and *Klebsiella* Species

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Abstract

Background: Optimal infection control strategies for limiting the transmission of extended-spectrum beta-lactamase-producing *Escherichia coli* and Klebsiella species (ESBL-EK) in the hospital setting remain unclear. The objective of this study was to evaluate the impact of a urine culture screening strategy on the incidence of ESBL-EK.

Methods: This prospective quasi-experimental study was conducted at two intervention hospitals and one control hospital within a university health system from January 2005 to February 2009. The intervention consisted of screening of all clinical urine cultures with *E. coli* or *Klebsiella* spp for ESBL-EK. Patients determined to be colonized or infected with ESBL-EK were placed in a private room with contact precautions. The primary outcome was nosocomial ESBL-EK incidence in non-urinary clinical cultures (cases occurring >48 hours after admission). Changes in monthly ESBL-EK incidence rates were evaluated using mixed effects Poisson regression models, with adjustment for institution-level characteristics (e.g., average length of stay, total admissions).

Results: The overall clinical incidence of ESBL-EK increased from 1.42 per 10,000 patient-days in the pre-intervention period to 2.16 per 10,000 patient-days in the post-intervention period. The incidence of community-acquired ESBL-EK (cases occurring ≤48 hours after admission) increased nearly three-fold over the study period, from 0.33 cases per 10,000 patient-days in the pre-intervention period to 0.92 cases per 10,000 patient-days in the post-intervention period (P<0.001). On multivariable analysis, the intervention was not significantly associated with a reduction in nosocomial ESBL-EK incidence (incidence rate ratio, 1.38; 95% confidence interval, 0.83-2.31; P=0.21).

Conclusions: Universal screening of clinical urine cultures for ESBL-EK did not result in a reduction in nosocomial ESBL-EK incidence rates, most likely due to increases in importation of ESBL-EK cases from the community. Further studies are needed on elucidating optimal infection control interventions to limit spread of ESBL-producing organisms in the hospital setting, including the role of active surveillance screening and effectiveness of contact precautions.

Background

- Infections due to extended-spectrum beta-lactamase-producing *Escherichia coli* and Klebsiella species (ESBL-EK) lead to increased morbidity and mortality
- Optimal infection control strategies for limiting the transmission of ESBL-EK in the hospital remain unclear.

Objective

- The objective of this study was to evaluate the impact of a urine culture screening strategy on the incidence of ESBL-EK.

Methods

- Study design: Prospective quasi-experimental study
- Setting: Two intervention hospitals and one control hospital w/in a university health system from January 2005 to February 2009
- Intervention: screening all clinical urine cultures with E. coli or Klebiella spp for ESBL-EK
  - → ESBL-EK colonized/infected patients were subsequently placed in a private room with contact precautions
  - → Initiated January 1, 2006
- Outcome: Nosocomial ESBL-EK incidence in non-urinary clinical cultures (cases occurring >48 hours after admission
- Statistical analysis: Changes in monthly ESBL-EK incidence rates were evaluated using mixed effects Poisson regression models, with adjustment for institution-level characteristics (e.g., average length of stay, total admissions).

Results

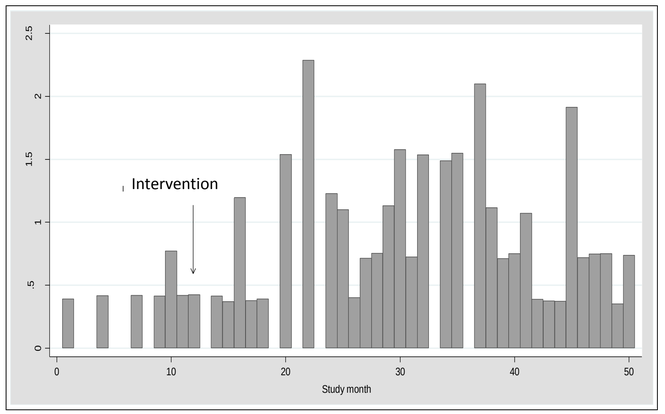
- The overall clinical incidence of ESBL-EK increased from 1.42 per 10,000 patient-days in the pre-intervention period to 2.16 per 10,000 patient-days in the post-intervention period.
- The incidence of community-acquired ESBL-EK (cases occurring ≤48 hours after admission) increased nearly three-fold over the study period, from 0.33 cases per 10,000 patient-days in the pre-intervention period to 0.92 cases per 10,000 patient-days in the post-intervention period (P<0.001).
- On MV analysis, the intervention was not significantly associated with a reduction in nosocomial ESBL-EK incidence (IRR, 1.38; 95% CI, 0.83-2.31; P=0.21).

Poisson mixed-effects model for noscomial ESBL-EK incidence

Variable	Incidence rate ratio (95% CI)	*P* value
Urine culture screening intervention	1.31 (0.82, 2.11)	0.26
Time[a]	1.01 (0.995, 1.03)	0.14
Hospital[b]		
Intervention hospital #2	0.70 (0.04, 14.1)	0.12[c]
Control hospital	2.73 (0.05, 138.7)	
Average daily census	1.00 (0.99, 1.01)	0.96
Average number of admissions	1.00 (0.998, 1.001)	0.80
Average length of stay	0.96 (0.61, 1.50)	0.86
Hospital-by-time[d]		
Intervention hospital #2 * time	0.98 (0.95, 1.01)	0.02[e]
Control hospital * time	0.96 (0.93, 0.99)	

[a]In months following the initiation of the intervention.
[b]Reference category, "Intervention hospital #1."
[c]Wald test of hospital terms in the final model.
[d]Reference category, "Intervention hospital #1 * time."
[e]Wald test for all hospital-by-time terms in the final model.

Incident non-urinary source community-acquired ESBL-EK cases per month from January 2005 to February 2009 for intervention hospitals.



Conclusions

- Universal screening of clinical urine cultures for ESBL-EK did not result in a reduction in nosocomial ESBL-EK incidence rates.
- This was most likely due to increases in importation of ESBL-EK cases from the community.
- Further studies are needed on elucidating optimal infection control interventions to limit spread of ESBL-producing organisms in the hospital setting.

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