Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomised trial

Derde LP et al., Lancet Infect Dis 2014, 14:31-9

Introduction

- Intensive care units (ICUs) are especially affected by three major groups of highly resistant pathogens—meticillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and highly resistant (i.e., resistant to third-generation or fourth-generation cephalosporins) Enterobacteriaceae (HRE).
- Several control measures have been advocated including improved adherence to standard precautions, chlorhexidine body-washing, introduction of contact precautions for known carriers of antimicrobial-resistant bacteria and putting carriers in single-patient rooms, and rapid detection of carriers at admission to ICU combined with isolation of carriers.
- Universal screening of patients at ICU admission for antimicrobial-resistant bacteria followed by contact precautions—a costly and labour-intensive intervention—remains the most controversial.
- **Aim:** To assess interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in European ICUs

Methods

- Inclusion of 13 European ICUs between May, 2008, and April, 2011, in three phases.
- **Phase 1:** 6-month baseline period.
- **Phase 2:** 6-month hygiene improvement program at all ICUs: optimized hand hygiene plus unit-wide implementation of chlorhexidine body-washing.
- **Phase 3:** 12–15 month cluster randomised trial to assess the additional effect of screening followed by contact precautions for identified carriers:
  - using either PCR for MRSA and VRE together with chromogenic screening for HRE: **rapid screening.**
  - or chromogenic-based screening for MRSA and VRE only: **conventional screening.**

13 ICUs were randomly assigned (1:1) to the rapid or conventional screening groups.

- Surveillance swabs from perineum, nose, and wounds were obtained within 2 days of admission to the ICU, then twice per week for 3 weeks, then once per week thereafter, for all patients admitted to ICU for 3 days or more.
- **Definitions:** Colonisation and bacteraemia were classed as ICU-acquired if detected on or after the third day of admission to the ICU, after a negative swab.
- **Primary endpoint:** Acquisition of MRSA, VRE, or HRE carriage per 100 patient-days at risk in ICU.
- **Statistical analysis:** multilevel Poisson regression analysis, allowing for random variation between ICUs for baseline levels and trends.
Results

- 8976 patients were included in the analyses. Seven ICUs were assigned to rapid screening and six to conventional screening.
- Mean hand hygiene compliance improved from 52% in phase 1 to 69% in phase 2, and 77% in phase 3.
- Median proportions of patients receiving chlorhexidine body-washing increased from 0% to 100% at the start of phase 2.
- In ICUs assigned to rapid screening, proportions of patients for whom contact precautions were taken increased for all antimicrobial-resistant bacteria compared with phase 2. In ICUs assigned to conventional screening, only MRSA-related and VRE-related contact precautions increased, consistent with protocol.
- At admission to the ICU, 3.6% of patients were colonised with MRSA, 4.7% with VRE, and 12.8% with HRE.
- For trends in acquisition of antimicrobial-resistant bacteria (Table 3), weekly incidence rate ratio (IRR) was 1.014 (95% CI 0.996–1.031) at baseline (phase 1) and deceased to 0.976 (0.954–0.999) for phase 2.
- For phase 3, there was no incremental effect on acquisition of antimicrobial-resistant bacteria (IRR 1.015 CI 0.998–1.032).
- The decrease in trend in phase 2 was largely caused by changes in acquisition of MRSA (weekly IRR 0.925, 95% CI 0.890–0.962). No evidence of step changes in acquisition or trends in either phase 2 or phase 3 for HRE and VRE, acquisition in each screening group was also much the same.
- Acquisition was lower in the conventional screening group than in the rapid screening group, but did not differ significantly (p=0.06).

Conclusions

- Improved hand hygiene plus unit-wide chlorhexidine body-washing reduced acquisition of antimicrobial-resistant bacteria, particularly MRSA.
- In the context of a sustained high level of compliance to hand hygiene and chlorhexidine bathings, screening and isolation of carriers do not reduce acquisition rates of multidrug-resistant bacteria, whether or not screening is done with rapid testing or conventional testing.
- These results are only generalizable to high endemicity settings.