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Abstract (poster session)

Modelling antibiotic resistance of Gram-negative bacteria (AR-GNB) during selective digestive tract decontamination (SDD) in intensive care units (ICU)

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Objectives: SDD is a prophylactic antibiotic regimen consisting of topical antibiotics (tobramycin (TOB), colistin (COL) and amphotericin B) applied in oropharynx and intestinal tract throughout ICU-stay, combined with a 4-day course of cefotaxime (CTX). SDD exerts continuous antibiotic pressure of TOB and COL and was associated with 87% increase in cephalosporin use (compared to standard care (SC)) (de Smet NEJM 2009). Yet, in Dutch ICUs SDD was also associated with 38% lower acquisition rates of AR-GNB. Using data from this study we investigated the dynamical interactions between antibiotic pressure (systemic and topical antibiotics) and admission rates of AR-GNB using a mathematical model. Methods: 1911 patients had at least 1 rectal culture result and the admission and acquisition rate of AR-GNB was determined for TOB+COL, CTX and TOB+COL+CTX. Parameters of the model (figure 1) were estimated by MCMC-simulations using uninformative priors. All available data on duration of stay with corresponding culture dates and results were used at an individual patient level. Posterior parameter estimates were applied to the same model without SDD antibiotic pressure (alpha1), without decontamination (p) and with a 47% reduction in CTX antibiotic pressure (alpha2). Sensitivity analyses were performed by adding various parameters of cross-transmission to the model. Results: 102 patients were colonized with AR-GNB (92 CTX, 3 TOB+COL and 9 TOB+COL+CTX). Median and 95% credibility intervals for overall resistance prevalence were 3.2% (2.6-4.0) during SDD and 9.2% (9.1-9.4) during SC. If the admission prevalence would increase 5-fold, mimicking settings with high endemicity of antibiotic resistance, overall resistance would be 12.7% and 24.5% during SDD and 26.4% and 50.0% during SC. Adding cross-transmission as a separate parameter to the model, resulted in overall resistance rates of 15% and 39% in low endemic setting for SDD and SC respectively and of 56% and 78% respectively in high endemic settings. Increasing the importance of cross-transmission, resulted in higher rates of overall resistance and smaller differences between SDD and SC. Conclusion: The model accurately reflects the observed beneficial effects of SDD on antibiotic resistance in Dutch ICUs, as compared to SC. The model also demonstrates that the beneficial effects remain with higher admission prevalence. Cross transmission reduces the beneficial effects, but SDD still outperforms SC.