TREAT – a system for balancing antibiotic treatment against development of drug resistance

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Introduction

Covering antibiotic treatment, matching in-vitro susceptibilities of subsequently isolated pathogens, reduces overall fatality rate of severe infections with adjusted odds ratios varying between 1.6 and 6.9. [1] In the same studies, 20-50% of patients were given non-covering empirical antibiotic treatment. The construction of a system, TREAT, that could advice on antibiotic treatment, thus reducing non-covering treatments would therefore be advantageous, provided this can be done without major increases in the cost of antibiotics, in the rate of side-effects and in particular in future resistance due to excessive use of broad-spectrum antibiotics.

Methods

A Causal Probabilistic Network (CPN) was developed to describe the diagnosis, treatment and prognosis of bacterial infections. For each patient decision theory was used to balance the expected benefit of the treatment, mainly improved survival, against the cost of drugs, side-effects and future resistance. Calibration to a given hospital was achieved through calibration databases, that for example would describe local resistance profiles and prevalences of pathogens or the local availability and cost of antibiotics. The TREAT system consists of the CPN, and of code linking it to a user interface and to the hospital's IT infrastructure [2].

Results

The TREAT system was tested in two clinical trials in hospitals in Germany, Italy and Israel. The first trial was a non-interventional trial, where TREAT was run in parallel to the clinical decisions, but where the advice of TREAT was not made available to the clinician. Among 1203 patients included in this study, TREAT prescribed covering antibiotic treatment significantly more frequently than physicians (70% vs. 58%, OR 3.67, 95% CI 2.17-6.22) using less broad-spectrum antibiotics at half of physicians' antibiotic costs.

The second trial was a controlled, randomized interventional trial, where 15 wards and 2326 patients participated. Clinicians in the study arm were given access to the advice from TREAT, but were not obliged to follow it. The rate of appropriate antibiotic treatment was higher in intervention vs. control ward patients (73% vs. 64%, OR 1.48, 95% CI 0.95-2.29). Length of hospital stay, costs related to future resistance and total antibiotic costs were significantly lower in intervention wards.

Conclusions

The TREAT decision support system has the potential for improving coverage and at the same time reduce the cost of treatment, as shown by the non-interventional trial. The interventional trial showed that some of the potential may not be realized because of non-compliance of the clinicians, but that a significant positive effect still remains.

References

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