TREAT System - Decision Support for Guidance of Empirical Treatment of Severe Bacterial Infections

When a patient is suspected to have bacteraemia episode, a blood sample is drawn and empirical antibiotic treatment is initiated. Inadequate empirical treatment of patients with bacteraemia is lethal in up to 40% of cases. Only 60% of patients are given adequate comprehensive treatment. The TREAT-system assists the medical doctor in initiating treatment and studies show an increase in adequacy in comprehensive treatment of up to 82%.

The clinical problem

Patients with bacteraemia have a 30-days lethality rate of 24-40%. Lethality is associated with inappropriate empirical antibiotic treatment. At the time of the first notification of a positive blood culture, appropriate empirical antibiotic treatment was given in 60% of bacteraemic episodes in the County of Northern Jutland in Denmark.

Adjustment of the empirical therapy was made in 45% of the cases. By using the more broad-spectrum antibiotics, the coverage of the treatment could be increased. This attempt would most likely result in an increased frequency of bacterial resistance, as there is a positive correlation between use of antibiotics and development of resistance. Therefore, the treatment of a current patient has to be balanced in some way to loss of possibilities for treating future patients.

Contributions to cost when deciding on empirical treatment also include the risk of side-effects and direct cost (purchase and administration).

The Decision Support System

A decision support system TREAT is a research project and is being developed for use at the empirical antibiotic treatment. TREAT is based on a database with a limited set of clinical data including 30-days lethality and bacterial resistance patterns.

A logical regression model has been constructed, which together with a BN and assessments of cost, form the system. Preliminary results show that the system proposes a covering treatment in 82% of the cases. On figure 1, a single decision module for a pathogen is shown. The node Ecoli is the stochastic variable representing a bacteraemia due to an E. coli infection in a certain site of infection. The node Treatment represents the different treatments, and the node ResFactors is whether or not there are resistance factors present. These two nodes determine how efficient the current treatment is for covering an E. coli bacteraemia, Cov_Ecoli. The node Ecoli* is identical to the node Ecoli; the asterisk indicates that some time, 1 - 2 days, has elapsed since the onset of the bacteraemic episode. Mort30_Ecoli represents E. colis contribution to the fatality of the infection. As can be seen in Figure 1, it is assumed that the fatality depends on the presence of the E. coli infection and the coverage of the therapies.

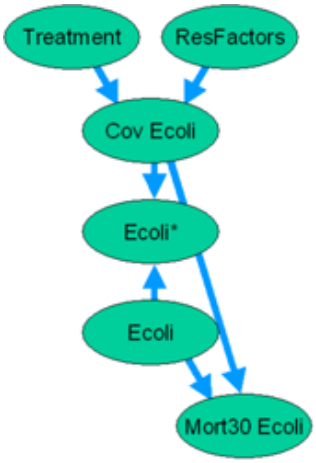

Figure 1 TREAT Decision Model

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