Marginal Structural Models for the effect of ICU-acquired nosocomial pneumonia on survival.

Stijn Vansteelandt, Ghent University, Belgium

Intensive care unit (ICU) patients are well known to be highly susceptible to nosocomial (i.e. hospital-acquired) infections due to their poor health and many invasive therapeutic treatments. The effects on mortality of acquiring such infections are, however, ill understood. Our goal is to quantify these using data from the National Surveillance Study of Nosocomial Infections in Intensive Care Units (Belgium). This is challenging because of the presence of time-dependent confounders, such as exposure to mechanical ventilation, which lie on the causal path from infection to mortality. Standard statistical analyses may be severely misleading in such settings and have shown contradictory results.

Inverse probability weighting for marginal structural models can be used to accommodate time-dependent confounders, but such models are not directly applicable because they infer the effect of acquiring infection on a given, fixed day `in ICU', which is ill-defined when ICU discharge precedes that day. Additional complications arise from informative censoring of the survival time by hospital discharge, and from the instability of the inverse weighting estimation procedure. We accommodate this by developing inference under a new class of marginal structural models for so-called partial exposure regimes. These describe the effect on the hazard of death of acquiring infection on a given day s, for ICU patients, had they had stayed in the ICU for at least s days.

This reflects joint work with Karl Mertens and Carl Suetens (Scientific Institute of Public Health, Brussels) and Els Goetghebeur (Ghent University, Ghent).