Summary

Antimicrobial drugs like antibiotics can be very effective in treating patients with infections, but due to increased use of these drugs, their effectiveness is diminishing because of development of antimicrobial resistance. This leads to increased morbidity, mortality, side effects and costs. Due to a lack of development of new antibiotics, appropriate use of antibiotics (i.e. only use antibiotics when really needed, treat as short as possible, use the most narrow-spectrum antibiotic possible) is paramount. Therefore, antimicrobial stewardship (AMS) programs have been initiated to improve antimicrobial prescribing.

To measure AMS effectiveness it is important to measure appropriateness of antimicrobial prescribing adequately, but this can be hard since it relies on a subjective evaluation of several factors, such as prescribing guidelines, patient characteristics, clinical reasoning of the physician, microbiological results and local practice. We therefore performed a study validating the judgments about antimicrobial appropriateness by an index infectious disease specialist, using judgments of his peers (Chapter 2). We showed that infectious disease specialists and clinical microbiologists agreed with the index expert’s judgment in 80% of cases, giving the method sufficient validity to be used in evaluation of AMS programs.

Improving antimicrobial prescribing actually means changing human behaviour, as prescribing physicians need to be persuaded into changing their current prescribing practice. However, previous AMS efforts have by and large failed to account for the intricacies and complexity of human behaviour, which may have lead to suboptimal effectiveness. We therefore used behavioural theory to design and implement an intervention approach to improve appropriateness of hospital antimicrobial prescribing for all indications: the Dutch Unique Method for Antimicrobial Stewardship (DUMAS) study. The approach was inspired by the participatory action research approach, which focuses on collaboration and empowerment of the stakeholders in the change process and is effective in other complex health care situations (Chapter 3). In essence, we measured antimicrobial appropriateness on seven wards in two hospitals and presented our results to the prescribing physicians themselves and asked them to reflect on it. We also presented them the findings of a root cause analysis of their inappropriate prescriptions, and we subsequently asked us what they wanted and needed to improve (e.g. better guidelines, education). We then acted upon these wishes in close collaboration with them. For instance, one department with prior low guideline adherence wished to rewrite the antibiotic guideline and so we did and appropriateness increased afterwards. Overall, the DUMAS approach was associated with a 13% increase in antimicrobial appropriateness sustained for 12 months post intervention-start. We found no reduction in antimicrobial consumption (Chapter 4).

More evidence on the importance and complexity of behaviour in prescribing was presented by our study showing antimicrobial appropriateness to be worse during mornings and when prescribed by inexperienced residents (Chapter 5). The follow-up qualitative survey showed that work-floor
physicians relate these findings to a suboptimal prescribing environment and they suggested improving this environment and improving supervisory support and education of physicians in antimicrobial prescribing and stewardship. Another variable to be influenced by time of day was blood culture-processing duration; in a retrospective study we found that median time from culture incubation-completion increased from a median of 4 to 16 hours depending on time of day of incubation completion. For clinicians, this means a sizable delay in the availability of potentially critical information about the responsible pathogen in bloodstream infections, with uncertain clinical consequences. The delay is caused by absence of laboratory night-time staffing and the offsite location of the laboratory, which is increasingly the case in the Netherlands (Chapter 6).

Education is an important intervention in AMS but it can be challenging to find the time and place for education on AMS in the crowded medicine curricula; and questions remain about long-term retention of knowledge and skills in traditional learning. We showed that e-learning on antibiotics can significantly improve medical students’ performance of an antimicrobial therapeutic consultation in a situation simulating clinical practice six months later (Chapter 7). With these promising results, it is even more important to achieve high e-learning participation rates, but these are often low, both in our studies and in literature. We therefore sought to get insight into the factors that determine E-learning participation. We found that participation in non-obligatory e-learning is higher in residents with more autonomous motivation (i.e. coming from within, as opposed to controlled motivation i.e. coming from external factors). Preceding e-learning on antibiotic prescribing with face-to-face education, to explain the importance of the subject, could enhance autonomous motivation and thus optimize e-learning efficiency (Chapter 8).