A cost-effectiveness analysis of antimicrobial treatment of community-acquired pneumonia taking into account resistance in Belgium

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
The aim of the study was to examine the cost-effectiveness of four outpatient antimicrobial treatments for mild to moderate community-acquired pneumonia (CAP), taking into account the impact of resistance in Belgium, from the perspective of the third-party payer. First-line treatment of CAP with moxifloxacin followed by co-amoxiclav was more effective and less expensive than other available treatments (co-amoxiclav, cefuroxime or clarithromycin). The study methodology was robust and the authors’ conclusions appear valid.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The aim of the study was to examine the cost-effectiveness of four outpatient first- or second-line antimicrobial treatments for mild to moderate community-acquired pneumonia (CAP) when considering the impact of resistance in Belgium. Mild to moderate CAP patients consisted of Fine risk category I to III who had not received any antimicrobial treatment in the previous 3 months.

Interventions
The four first-line antimicrobial treatments considered were moxifloxacin, co-amoxiclav, cefuroxime and clarithromycin. The corresponding second-line therapies in case of failure were, respectively, co-amoxiclav, clarithromycin, moxifloxacin and moxifloxacin. Patients who failed first-line therapy could also be hospitalised, while all patients failing second-line therapy were hospitalised. Moxifloxacin was given at a daily dose of 400 mg for 10 days, co-amoxiclav at 2,625 mg for 10 days, cefuroxime at 1,500 mg for 10 days and clarithromycin at 1,000 mg for 5 days.

Location/setting
Belgium/outpatient.

Methods
Analytical approach:
A published decision analytic model was adapted to the Belgium setting in order to compare the cost-effectiveness of the alternative treatments. The time horizon of the analysis corresponded to the duration of a CAP episode. The authors stated that the perspective of the third-party payer was adopted in the analysis.

Effectiveness data:
The clinical estimates appear to have been derived from a selection of known, relevant studies. Clinical failure could occur for two main reasons: lack of response in patients with susceptible pathogens, or failure due to the presence of antimicrobial-resistant pathogens. Failure rates in susceptible pathogens came from published randomised clinical trials (RCTs) that were combined by means of simple averages. Failure rates in antimicrobial-resistant pathogens came from surveillance studies, supplemented by expert opinion, given the lack of other published evidence. When available, epidemiological data were taken from Belgian studies. The prevalence of microbial pathogens came from a German study.

Monetary benefit and utility valuations:
None.
Measure of benefit:
Four benefit measures were used and combined with the costs. These were rate of first-line failure, rate of second-line treatment, hospitalisation rate and death rate.

Cost data:
The economic analysis included the costs of drugs, general practitioner (GP) office visits, GP home visits, specialist office visits, emergency room visit, chest X-ray, white blood cell count and hospitalisation. The resource use data were derived from the literature (details not given). The costs were mainly obtained from a large Belgian insurance company, which acts as a third-party payer. Further cost data were obtained from published sources, for example, a French study. The costs were in euros (EUR) and, when necessary, were inflated to the price year 2006.

Analysis of uncertainty:
A deterministic univariate sensitivity analysis was undertaken on key model inputs in order to ascertain the robustness of the incremental cost-effectiveness ratios. The ranges of values and alternative assumptions investigated in the sensitivity analysis appear to have been determined subjectively by the authors. A probabilistic sensitivity analysis based on a 10,000-iteration Monte Carlo simulation was also performed by assigning probabilistic distributions to the model inputs. The types of probabilistic distributions were described. Cost-effectiveness acceptability curves were generated and presented.

Results
The expected costs were EUR 143.53 with moxifloxacin/co-amoxiclav, EUR 221.97 with co-amoxiclav/clarithromycin, EUR 211.16 with cefuroxime/moxifloxacin and EUR 192.79 with clarithromycin/moxifloxacin.

The rates of first-line failure, second-line treatment, hospitalisation and death were, respectively:
- 5%, 4.23%, 1.43% and 0.01% with moxifloxacin/co-amoxiclav;
- 15.65%, 13.24%, 4.28% and 0.04% with co-amoxiclav/clarithromycin;
- 19%, 16.08%, 3.73% and 0.03% with cefuroxime/moxifloxacin; and
- 18.13%, 15.34%, 3.56% and 0.03% with clarithromycin/moxifloxacin.

The incremental analysis revealed that moxifloxacin followed by co-amoxiclav was the dominant treatment, as it resulted in lower costs and greater benefits than the other treatments.

The univariate sensitivity analysis showed that the base-case findings were robust in many scenarios, owing to the absence of resistance to moxifloxacin and its high clinical success rate. This result was further confirmed in the probabilistic sensitivity analysis, where moxifloxacin/co-amoxiclav was dominant in 99.4% of cases compared with co-amoxiclav/clarithromycin, in 99.9% of cases compared with cefuroxime/moxifloxacin and in 92.6% of cases compared with clarithromycin/moxifloxacin.

Authors' conclusions
The authors concluded that first-line treatment of CAP with moxifloxacin followed by co-amoxiclav was more effective and less expensive than other available treatments (co-amoxiclav, cefuroxime or clarithromycin) from the perspective of the Belgium third-party payer.

CRD commentary
Interventions:
The authors justified the choice of the treatments under examination, which were recommended by Belgian guidelines and reflected prevailing treatment pathways in Belgium.

Effectiveness/benefits:
The authors did not report the methods and conduct of a review of the literature. Thus, the primary sources of data were
presumably derived from a selection of known studies. The current model was an adaptation of a model used in a previous economic analysis, thus only epidemiological data specific to the Belgian setting were sought. The use of RCTs as a source of effectiveness data was appropriate given the strengths of these studies. The authors discussed the selection of other estimates from amongst those available in the literature. The use of some assumptions was justified on the grounds of a lack of reliable published evidence.

Costs:
The categories of costs included in the analysis were consistent with the authors' stated perspective. The unit costs and the quantities of resources used were presented separately for most items. The unit costs were presented for all items, but little information on resource consumption was given. The sources of the costs reflected the Belgian health care system. The resource use data were derived from the literature, although details of these sources were not reported. The price year was stated, which enables refutation exercises in other time periods.

Analysis and results:
The synthesis of the costs and benefits was appropriate. The calculation of incremental cost-effectiveness ratios was not required, owing to the dominance of one treatment over the others. The issue of uncertainty was well addressed in the sensitivity analysis. The results of the study were presented clearly and discussed. Model results should be considered as specific of mild to moderate CAP patients and cannot be extrapolated to severely ill patients.

Concluding remarks:
The quality of the study methodology was good, with clear description of the sources used and study findings. The authors' conclusions are likely to be valid and were corroborated by the extensive sensitivity analyses.

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