

Antibacterial resistance and the cost of affecting demand: the case of UK antibiotics

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BACKGROUND

- Antimicrobial resistance (AMR) has become a global threat, and if the problem goes unchecked there will be an estimated 700K deaths worldwide annually. Consequently, this has prompted calls for a global response (WHO, 2001). Based on these concerns, the British government commissioned [a report of antimicrobial resistance](#), which was tasked with identifying causes of rising drug resistance and to propose policy actions that can be taken internationally. Two key issues identified in the government's report, and relevant to this paper, are (1) lack of incentives for firms to undertake research and development (R&D) of new antibiotics, and (2) demand management towards appropriate/optimal use.
- Regarding the first issue, industry reports suggest that lack of profitability of this market can explain why firms are no longer investing in R&D for new antibiotics. New molecules launched after 2000 have limited coverage of the market. To this end, we document market structure and profit margins for the UK pharmaceuticals sector for antibiotics by drug type and firms (branded, generic, R&D active firm or not, molecule class, broad/narrow spectrum).
- Regarding the second issue, high (and often inappropriate) use of antibiotic consumption contributes to the rising antimicrobial resistance. Narrow-spectrum antibiotics can be prescribed when causative organism is known but require additional tests to identify the bacterial pathogen. On the other hand, broad-spectrum antibiotics are prescribed more generally but they also exacerbate the AMR problem. Of particular concern is the over use of broad-spectrum antibiotics since the additional costs of testing are not internalized by prescribing physicians. We test the feasibility of supply side interventions to encourage switch from broad- to narrow-spectrum drugs and compute the firm profits and social cost of the switch.

METHODOLOGY

- Using ten years aggregate sales data for antibiotics dispensed in UK pharmacies, we estimate a structural demand mode (discrete choice random coefficients) to evaluate market performance of firms by spectral activity of each drug.
- Based on our estimates, we analyse substitution patterns between drugs in different spectral groups. We also simulate counterfactual scenarios to evaluate the effectiveness of cost-side interventions via taxes on selected broad-spectrum drugs to shift demand from broad- to narrow-spectrum drugs, and compute the implied short term societal costs (changes in consumer welfare, firm profits and additional testing costs).

KEY FINDINGS

- Prices have declined over the last decade, but marginal costs have declined even more, leading to an overall improvement in the sector's profitability over time. However, in the UK, it is the generic firms that enjoy higher margins. This fact may provide a partial

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explanation on why there is a reduced investment in R&D. Similarly, broad-spectrum antibiotics have lower costs and higher margins than narrow-spectrum agents.

- Simulations show that if unit costs of broad-spectrum were as high as those of narrow-spectrum antibiotics (say due to a unit tax), demand for broad-spectrum would fall by 28.1%, while that of narrow-spectrum would increase by 43.8%. The welfare cost of such an intervention would be £962 per thousand individuals or a total of £ 61.26 million for 2012 (last full year of our data) and is inclusive of change in consumer welfare, firm profits, and additional cost of testing for pathogens before prescribing narrow-spectrum antibiotics. Impact of a more selective ad valorem tax on a subset of broad-spectrum drugs by their molecule class is also analysed, which leads to a much lower societal cost and a significant reduction in demand for the targeted molecules.

POLICY ISSUES

- Estimated substitution patterns and simulations show that switching from broad- to narrow-spectrum is possible via changes in relative prices, but it has significant implications for consumer surplus as well as for firm profits. The two tax regimes differ in how much demand will shift and what it will cost to society to implement these interventions.
- Our estimates should not be taken as full calculation of welfare as we do not account for long term benefits that accrue to consumers due to reduction in AMR (which would reduce loss in consumer surplus). They should however be interpreted as an upper bound to the total cost of such an intervention as we account for increase in cost due to additional testing. Compared to the societal cost of AMR in terms of death and direct costs in government reports, this may not be a large price to pay for reduction in AMR.

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