Solving the problem of antimicrobial resistance: is a global approach necessary?

'Optimal containment of antimicrobial resistance requires a global approach co-ordinated with local and national strategies'.

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The ability of microorganisms to become resistant to the therapies used against them has long been recognized, and resistance rates for many isolates, although variable across location, are rising rapidly [1–3]. Although many factors contribute to resistance, it is strongly associated with the (mis)use of antimicrobials themselves [4]. Resistance, in reducing the effectiveness of antimicrobial therapies, increases morbidity, mortality and health care expenditure [5,6].

Although resistance is essentially the result of individual decisions concerning antimicrobial treatment made by doctors and/or patients, its impact is global, affecting all regions of the world and unrestricted by national boundaries. The increased mobility of people, animals and goods over recent decades has accelerated the spread of infectious disease, and with it the spread of resistance, such that every country is now dependent upon its neighbours in seeking to contain resistance [4].

However, this interdependence tends to be ignored because of the diffuse individual decision-making concerning the use of antimicrobials, which essentially balances the costs and benefits to the patient of the consumption of an antimicrobial and ignores the 'externality' effect of resistance that reduces the future effectiveness of the therapy. The result is that what might be optimal for the patient is not necessarily optimal for society [7]. Without intervention, patient costs and benefits will dominate decisions about antimicrobial usage, and antimicrobial resistance will continue to rise inexorably.

To 'solve' the problem of resistance, there are two broad strategies: (1) develop new antimicrobial and/or alternative treatments so that resistance is no longer important and/or (2) implement policies to fight resistance. A pre-requisite to both of these strategies is the development of surveillance systems that provide understanding of the particular problems faced. Each of these requires a global, as well as a national, approach to be most effective, as outlined briefly here.

Developing new treatments

The development of new treatments is essentially a contribution to knowledge. It is a classic 'public good' – knowledge can be freely used by all without its use by one person inhibiting use by others [8]. In practice, however, the cost of R&D into drug therapies means that patents are used to transform this knowledge into a 'private good', from which people can be excluded, thus maintaining incentives for investment [9]. However, international differences in pricing structures, patent laws, intellectual property rights legislation, and drug registration and licensing enable companies to engage in differential research and development policies; for example, targeting the development of drugs that focus on the problems of wealthier countries. Collective action is, therefore, necessary for the reform of international patent laws and the co-ordination of licensing and regulatory requirements [10].

A further key element in solving the problem of resistance is to encourage R&D in antimicrobial treatments and their alternatives, given that the profits available from such development might be threatened by policies aiming to contain resistance by reducing consumption of antimicrobials. Importantly, therefore, a global approach might be necessary for directly undertaking or sponsoring R&D where profit levels do not provide the incentive for private firms to undertake such work.

Implementing policies to fight resistance

It is unrealistic and undesirable to eradicate resistance: to do so would require significant reductions in the use of

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antimicrobials and concomitant increases in current morbidity and mortality. The aim must therefore be to contain resistance, optimizing the balance between the current use of effective antimicrobials to treat infection (thus reducing current morbidity and mortality), and the emergence and spread of resistance to these antimicrobials (in turn leading to increased future morbidity and mortality). There are two aspects to the containment of resistance: avoiding its emergence and preventing its transmission [11]. The vast number of policies that aim to contain resistance can be classified in this way. Policies for containing the emergence of resistance include, for example, professional and patient education, restriction of drug availability and antimicrobial cycling. Policies for preventing transmission include, for example, rapid diagnostic techniques, patient isolation and improvements in bed spacing [12].

Many of these policies are appropriately operated at a local or national level because of the diverse contexts in which they have to be implemented, as well as variations in resistance to infective agents even across relatively small areas. The extent to which countries invest in such policies, however, might not be optimal from a global perspective if countries fail to take account of the cross-border effects of their actions. This means that the sum of actions by individual nations will not provide sufficient response at a global level and, therefore, some element of collective action is required. There could be a place for the use of financial incentives and disincentives at the global level, as well as for international legislation that encourages the optimal use of antimicrobials. Aid might also be required to enable some countries to provide a level of response that is globally optimal, but might not be a priority for the individual nation.

Surveillance

Surveillance is fundamental to the containment of resistance [13]. It provides data to locate particular problems, monitor the growth and transmission of resistance, and determine the impact of particular strategies [13], without which it is difficult to formulate adequate policies. A global approach to surveillance is likely to be much more efficient than a myriad of local approaches because: (1) the barriers to establishing surveillance systems are high given the large initial investment required; (2) surveillance produces benefits for other countries that an individual nation does not account for in deciding whether to invest in a surveillance system; and (3) a global approach acquires comparable data [4].

Conclusion

To conclude, only a co-ordinated global approach will provide an optimal basis for solving the problem of antimicrobial resistance: adequate strategies of collective action will be vital in avoiding much of the future morbidity, mortality and cost from resistance. There are, however, two important provisos. First, the recognition of the need for a global response could provide countries with the excuse to do nothing while awaiting its development, or to 'free-ride' on the efforts of others. Second, and perhaps more important, is that a global response is necessary but not sufficient: local and national policies are also vital and, indeed, any global strategy will have to be implemented at the national and local level [13].

Acknowledgements

The Department of Social Medicine of the University of Bristol is the lead centre of the MRC Health Services Research Collaboration.

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