

ReAct facts

A fact sheet from ReAct – Action on Antibiotic Resistance, www.reactgroup.org

First edition 2007 – Last updated May 2008

Economic Aspects of Antibiotic Resistance

◆ Resistance to antibiotics results in an extensive increase in costs to the patient and family, the hospital, and society, due to the need for the use of more expensive drugs for second line treatment, more tests and much longer stays in hospital, as well as

longer sick leave, or even premature death.

◆ However, an even greater economic burden lies in the future and will affect generations to come, when the consequences of current use (and misuse) of antibiotics could lead

to the loss of all the advantages in medical care that they have brought about. Advanced surgical procedures and cancer chemotherapy might be impossible to perform, resulting in enormous costs, economic as well as human.

INTRODUCTION

- Antibiotics are essential in the prevention and cure of bacterial infections.
- The use of antibiotics generates resistance to their effects, reducing their effectiveness in the prevention and cure of disease.
- Resistance is associated with antibiotic usage (appropriate or otherwise), and the interaction of microorganisms, people and the environment.
- Resistance is therefore not eradicable, but will have to be managed.
- Antibiotics are a scarce resource as current use decreases their future value.
- This requires an assessment of the balance between the positive effects of using antibiotics and the negative impact of this use on their temporal effectiveness.
- Resistance has to be included as a factor when assessing the relative costs and benefits of the use of antibiotics.



DEFINITION OF THE PROBLEM

- In economic terminology, resistance is a negative externality. That is, it has an undesirable effect on people other than the immediate consumer.
- This is referred to as an external cost, as it is an undesirable effect (and hence cost) on those other than the consumer making the consumption decision.
- This external cost is cross-sectional

as it is imposed on people other than the consumer, but also temporal in the sense that when the consequences of resistance have appeared a cost is also borne by the consumer.

It has to be remembered that:

- we are looking at containment of resistance, not eradication
- it is important to assess the optimisation of use of antibiotics over time

□ in addition to direct costs to the patient, the family and hospital, it is critical to assess social costs and benefits of antibiotic use and strategies to contain resistance (i.e. including positive and negative externalities). These strategies will be wide-ranging and encompass the development of new antibiotics, the use of alternative treatments and prevention of infectious disease.

QUALITATIVE CONSEQUENCES OF RESISTANCE

Treatment failure is the main contributor to increased costs and can lead to:

- additional investigations such as laboratory tests and X-ray examinations
- additional or alternative treatments, often much more expensive than drugs used to treat infections caused by sensitive organisms
- additional side-effects from more toxic treatments, which have to be managed
- longer hospital stay
- longer time off work
- reduced quality of life
- greater likelihood of death due to inadequate or delayed treatment
- increased burden on family of infected individual
- increases in private insurance coverage
- additional cost for hospital when hospital-acquired infection occurs and infection control procedures are required
- increased overall healthcare expenditure, including costs of combating transmission

- increased cost of disease surveillance
- increased costs to firms of absenteeism
- possible increase in product prices due to increased costs to firms

These consequences, however, relate only to the direct (and some indirect) impacts of resistance itself. Also very important is the impact that resistance will have on the ability to deliver other forms of health care.

Antibiotics are the cornerstone of modern medicine that revolutionized medical care during the last half of the previous century. From cradle to grave the role of antibiotics in safeguarding the overall health of human societies is pivotal.

So the costs of antibiotic resistance relate to the loss of these benefits and associated treatment possibilities at every stage of human life. Thus, in order to calculate the full economic burden of antibiotic resistance we have to consider the burden of not having antibiotics at all, which at the extreme would probably collapse the entire modern medical system.

The figures below vastly under-represent the actual cost of resistance once it begins to affect these other aspects of medical care, such as any surgical therapy.

Besides this alarming future scenario antibiotic resistance already has an impact on the care of patients with bacterial infections, which are not yet caused by resistant strains. Broader-spectrum antibiotics are now being prescribed as first-line drugs, when a certain level of resistance has been detected in the area. This often means more expensive drugs, greater risk of side effects, and occasionally more

tests to be performed, thus increasing the costs substantially.

QUANTITATIVE CONSEQUENCES OF RESISTANCE

There are difficulties in assessing the exact costs incurred by antibiotic resistance, one reason being the impact of the underlying disease.

By country

- Cost to US medical care sector of treatment for patients with infections caused by resistant organisms estimated to be \$4-7 bn per year.^{1,2}

By institution

- Cost to a general hospital of containing a 5-week outbreak of MRSA – approximately £500,000.³

By disease

- Tuberculosis – double the cost of standard treatment (\$13,000-\$30,000)⁴; multidrug resistant tuberculosis, MDRTB – treatment cost increased to \$180,000 (CDC estimate).⁵
- Vancomycin-resistant enterococci infections – average extra cost of \$12,766 per case in comparison with controls, due for example to more and longer ICU admissions and additional hospitalization days; patients also more often discharged to long-term facilities, thereby increasing costs beyond hospitalization.⁶
- Infections with ESBL producing Enterobacteriaceae – costs and hospital charges increased 1.56 and 1.71 respectively in two studies.^{7,8}



◆ ReAct links a wide range of individuals, organisations and networks around the world taking concerted action to respond to antibiotic resistance.

◆ Our vision is that current and future generations of people around the globe should have access to effective treatment of bacterial infections.

◆ ReAct believes that antibiotics should be used appropriately, their use reduced when of no benefit and their correct and specific use increased when needed.

◆ ReAct believes that awareness of ecological balance is needed as part of an integral concept of health.

- Pneumonia caused by penicillin-nonsusceptible *Streptococcus pneumoniae* – treatment more expensive than treatment of pneumonia caused by susceptible strains, despite the disease being milder; higher costs due to longer hospital stay (26.8 vs 11.5 days) and more expensive medicines (\$736 vs \$213).⁹
- In a study regarding patients undergoing surgery, the cost of infections due to resistant gram-negative bacilli was compared with infections due to non-resistant strains. The difference in the median hospital cost was \$51,000 and the difference in the median cost for antibiotics was more than \$1,800 per case.¹⁰



The consequences of current use (and misuse) of antibiotics could lead to the loss of all the advantages in medical care that they have brought about.

PERSPECTIVES

The economics of containing resistance

Strategies to contain resistance are many. In a review, studies of strategies that looked at effectiveness and/or cost-effectiveness were evaluated.¹¹ It was concluded that studies were generally:

- of poor methodological quality (high risk of bias)
- from developed nations (principally the USA)
- not measuring the cost impact of ABR
- micro (institution) not macro (community)
- focused on transmission of resistance, not emergence

This creates a two-fold problem:

- Because of uncertainty, the evaluation of strategies to reduce transmission is easier to undertake than evaluation of strategies to control emergence, and because of discounting of future benefits, strategies to

reduce transmission are likely to appear more cost-effective than strategies to control emergence.

- Micro policies – generally to contain transmission – are more likely to be rigorously evaluated but macro policies – generally to contain emergence – are more likely to be socially optimal in the long-term.

Urgent needs

- More work to develop and undertake macro-economic evaluation.
- Assessment of the wider impact of resistance on health care delivery, thus focusing on the wider cost rather than the narrow direct implications of resistance.

SUGGESTIONS FOR FURTHER READING

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