

Introduction

Infectious diseases account for about one-quarter of all deaths worldwide. Since the introduction of penicillin in the 1940s, antibiotics have occupied a central place in the treatment of bacterial infections and make possible many of the procedures of modern medicine such as cancer chemotherapy, organ transplantation and the care of premature babies. Although there have been major advances in research into, and treatment of, many communicable diseases, continuing progress in tackling these major challenges for public health is threatened by the dramatic increase in the number and distribution worldwide of pathogens resistant to antimicrobial (antibacterial, antiviral, antiparasitic and antifungal) drugs. For example, a recent report by the UK Chief Medical Officer¹ concludes that “*antimicrobial resistance poses catastrophic threat*”. The latest G8 Science Ministers Statement (2013) focused on the global challenge of antimicrobial resistance and the World Health Organisation expressed concern that this rapidly growing problem may impede progress towards the Millennium Development Goals 2015². The global pandemic of antibiotic resistance in both community care and hospital-associated infections represents a major health and economic burden and this crisis is being exacerbated by a relative lack of innovation in generating new antibiotics: we are in danger of returning to a pre-antibiotic era.

Previous work by Academies

Many academies of science and medicine have a long history of interest in analysing the issues, identifying approaches to tackling antimicrobial resistance and offering options to resolve the problem of declining antibiotic innovation (for example, by creating new structures and incentives for industry investment and public-private partnership). The first scientific conference of IAMP in 2002 addressed issues for antibiotic resistance and EASAC, the European Academies Science Advisory Council, one of the Regional Academy Networks of IAP, published a series of outputs (2005-2011)³ raising the

visibility of the topic and providing recommendations for EU policy-makers. Other recent European work⁴ on antibiotic resistance, provides detailed analysis of some of the research opportunities and a Statement published by the G8 science academies together with other science academies⁵ focused on the broad issues for tackling drug resistance.

Taken together, the work of the academies has compiled a broad range of recommendations for policy development to combat antimicrobial resistance with specific proposals for the coordinated action needed in support of surveillance, technical assistance, research and innovation. It is vital both to preserve the efficacy of existing antimicrobial agents and accelerate the discovery and development of new agents. To be successful, this broad strategy requires a higher political and public profile and a cross-sectoral approach involving health, agriculture, development, economics and other sectoral policy areas.

Increasing political focus worldwide

At the 66th World Health Assembly (May 2013) there was increasing recognition by many WHO member states that antibiotic resistance poses a significant threat to global health⁶. This threat must now receive much greater prominence in global strategic discussions. For example, in the recent report⁷ of the High-level Panel of Eminent Persons on the post-2015 development agenda, nothing specific was included about resistance in the illustrative goals for health, even though it was recognised that the burden from communicable disease must be reduced. In the opinion of IAP and IAMP, it is a priority for the current UN discussion on the post-2015 development agenda to acknowledge that antimicrobial resistance is a present major public health threat and this acknowledgement must then inspire the urgent construction and improvement of coordinated and consistent approaches to tackling the problem worldwide as part of the goals for sustainable development.

Recommendations from IAP and IAMP

IAP and IAMP strongly support the conclusions derived from previous academy work with the aim to deliver an integrated strategy for effective and efficient action now and to prepare for the future. We also take this opportunity to re-emphasise the core importance of new knowledge to underpin all the recommended actions, and

¹ Annual Report of the Chief Medical Officer, Volume 2, 2013, Infections and the rise of antimicrobial resistance, <http://media.dh.gov.uk/network/357/files/2013/03/CMO-Annual-Report-Volume-2-20111.pdf>

² WHO, Fact sheet no. 194, updated 2013, on <http://www.who.int/mediacentre/factsheets/fs194/en>. More information on WHO activities regarding antimicrobial resistance is on <http://www.who.int/drugresistance/en/index.html>. The challenges worldwide are also discussed in the Global Risks 2013 Report of the World Economic Forum on http://www3.webforum.org/docs/WEF_GlobalRisks_Report_2013.pdf and examples of initiatives on antibiotic resistance in developing countries are described in the Chennai Declaration on <http://chennaideclaration.org/news.htm> and in the work on Mobilising Civil Society Organisations on <http://cso.reactgroup.org>.

³ Summarised in EASAC policy report 14, 2011, European public health and innovation policy for infectious disease: the view from EASAC, <http://www.easac.eu>.

⁴ Antibiotics Research: Problems and Prospects, 2013, German National Academy of Sciences Leopoldina and Academy of Sciences, Hamburg.

⁵ Drug Resistance in Infectious Agents – A Global Threat to Humanity, 2013

⁶ Summary report provided by permanent mission of Sweden in Geneva, Antibiotic resistance – a threat to global health security and the case for action, <http://www.swedenabroad.com>.

⁷ The report of the high-level panel of eminent persons on the post-2015 development agenda, A new global partnership: eradicate poverty and transform economies through sustainable development, <http://www.post2015hlp.org/wp-content/uploads/2013/05/UN-Report.pdf>.

the continuing responsibility of the academies and academy networks to advise on what is necessary and feasible. If the current major public health problem of antimicrobial resistance is to be reduced and if a much worse crisis is to be averted, in the view of IAP and IAMP there is particular need for global involvement:

- Acting now to ensure that tackling antimicrobial resistance has a central place in the strategic agenda for sustainable development worldwide.
- Developing and promoting integrated global surveillance systems (humans and animals), to gather, analyse and disseminate data and provide the evidence base for action for “one health” across the sectors.
- Developing and implementing information and education programmes on the rational and prudent use of anti-infective drugs, including optimising prescribing options, for professionals in public health and in veterinary medicine. Antibiotic stewardship requires action by dedicated teams with analysis, sharing and implementation of “what works”. The current use in many countries of antibiotics in animal husbandry (growth promotion) must be curtailed and other applications in agriculture re-examined.
- Initiating education programmes for patients and the public on the prevention and management of infections; this information must also include communicating the urgent need to advance therapeutic innovation.
- Supporting infection prevention and control programmes – such as vaccination, hygiene and sanitation – and ensuring access to these for all in community care and in hospitals.
- Encouraging industry innovation, new business and collaborative R&D models, in partnership with the public sector, to develop novel anti-infective drugs, including those for currently neglected diseases. Innovative public funding mechanisms should be explored, to decouple return on investment from volume of sales, thereby encouraging knowledge sharing and helping to ensure affordable access to treatment. The renewed commitment to pharmaceutical innovation must be accompanied by reform to facilitate science-based regulatory frameworks that strike an appropriate balance between speed and safety in approving novel antibiotics.
- Encouraging development of novel rapid diagnostics to improve early detection and targeting of antibiotic treatment in clinical care, enable more efficient recruitment of patients with multi-resistant disease into clinical trials, and improve surveillance of emerging resistance..

- Recognising that migrant populations and medical tourists may import resistant microbes – with implications for screening to characterise infections in these vulnerable groups.
- Increasing research capability worldwide to advance new science, interdisciplinary linkages and to grow clinical research capacity, in order to control and prevent emergence of antimicrobial drug resistance. The agenda must include fundamental bioscience research and modelling to understand the origin, evolution and spread of resistance and to identify novel pathogen targets. Commitment to research in the social sciences is also needed to understand the societal determinants of the spread of resistance and to clarify the economic incentives available to confront resistance.
- Doing better in generating and using research requires new insights and new structures, including:
 - (i) New ways of thinking about directions in fundamental research to provide the knowledge resource to stimulate innovation – for example a workshop organised by European academies in 2014 will bring together leading researchers to share perspectives on what might be considered possible to create novel scientific approaches to combating infection.
 - (ii) New structures for partnership to support the global research and innovation agenda as well as to build and support sustained surveillance, stewardship and infection control programmes. The recently initiated EU Joint Programming Initiative⁸ on antimicrobial resistance might serve to help catalyse broader international sharing of research priorities and projects. There must also be better sharing of research data, with the commitment to open access.
 - (iii) New centres of excellence in research and innovation – and this requires strengthening health research capacity in developing countries⁹.

In conclusion, antimicrobial resistance is a global threat, requiring collaboration worldwide to generate the resources for antibiotic innovation and to ensure optimal treatment for all.

*IAP is the global network of 106 science academies representing more than 100 countries worldwide. <http://www.interacademies.net>
IAMP is the network of the world's medical academies and medical sections of science academies. <http://www.iamp-online.org>.
Their Secretariats are hosted by TWAS, in Trieste, Italy <http://www.twas.org>*

⁸ JPIAMR, <http://www.jpiaamr.eu>.

⁹ IAMP, A call for action to strengthen health research capacity in low and middle income countries, <http://www.iamp-online.org>.