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Future Directions: Public Health

The example of antimicrobial resistance

Valuing Our Life Support Systems
Natural Capital Initiative
British Library, 7 November 2014

Professor Anthony Kessel
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International Programme for Ethics, Public Health and Human Rights
London School of Hygiene & Tropical Medicine

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Outline of talk

- What is public health?
- The example of antimicrobial resistance
- Environmental philosophy and public health
- Conclusions

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Definitions of public health

"..the art and science of preventing disease, promoting health, and prolonging life through organised efforts of society."

Donald Acheson, London, 1988. Committee of Inquiry into the Future Development of the Public Health Function. *Public health in England*. London: HMSO, 1988.

"collective action in relation to the health of populations."

Porter D. *Health, civilization and the state: a history of public health from ancient to modern times*. London: Routledge, 1999

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Timeline I: Discovery of microbes and the first systematic infection control policies in hospitals

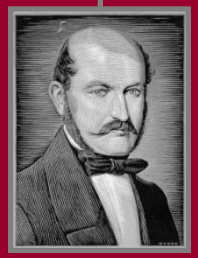
Anton van Leeuwenhoek

1676

discovery of bacteria

1840s

antiseptic hand wash



Ignaz Semmelweiss

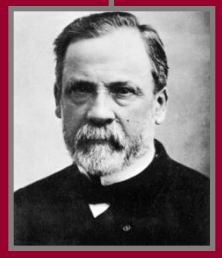
Florence Nightingale

1847

hygiene in field hospitals

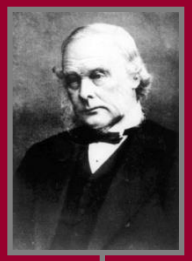
1864

proposition of germ theory



Louis Pasteur

Joseph Lister

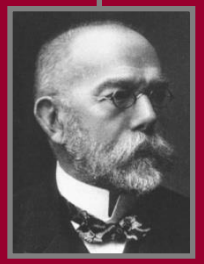


1870

introduction of antiseptic surgery

1890

causal link between bacteria and disease



Robert Koch

Theory of Miasma

Germ Theory

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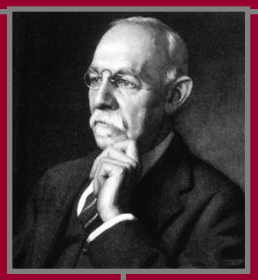
Timeline II: From germ theory to antimicrobial therapy

William S. Halstead

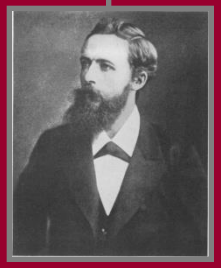


1890

introduction of surgical gloves

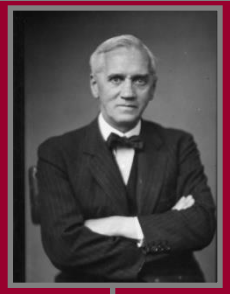
Introduction of surgical masks

1897



Johannes Mikulicz-Radecki

Alexander Fleming

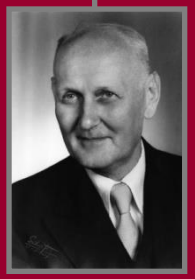


1928

discovery of penicillin

discovery of sulfonamides

1932



Gerhard Domagk

Selman Waksman

1943

Streptomycin is discovered

Pre-antibiotic age

Antibiotic age

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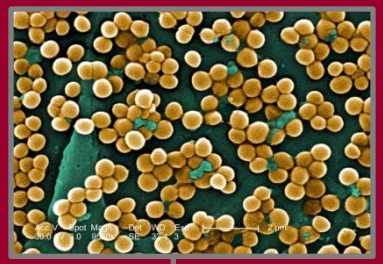
Timeline III: From antimicrobial therapy to antimicrobial resistance

Penicillin resistance



1948

Resistance observed in Staphylococci

1952

Streptomycin first used in agriculture

Treatment for plant diseases

1955

First MDR case

S. Dysaentriae outbreak in Japan

Methicillin resistance in S. aureus

1961

First case of MRSA

1993

WHO declaration

TB & MDR-TB 'global health emergency

First confirmed case of completely drug-resistant TB in Mumbai*

2011

Complete drug resistance

Pre-antibiotic age

Post-antibiotic age?

*http://www.bbc.co.uk/news/health-16592199

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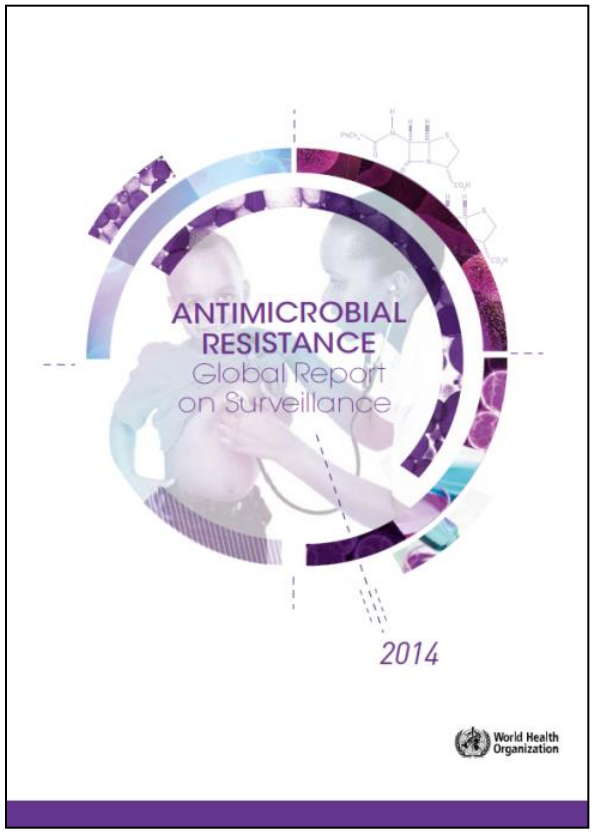
Global Picture: Antimicrobial Resistance



World Health Organization 2014 surveillance report:

"...very high rates of resistance have been observed in all WHO regions in common bacteria…"

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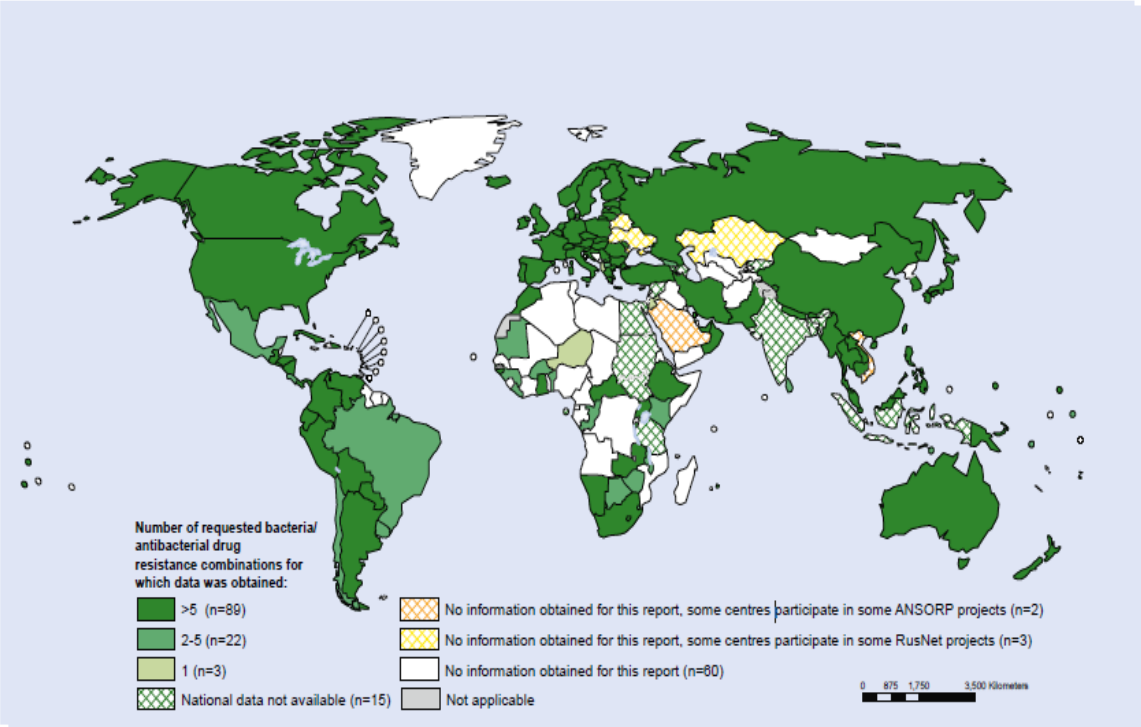
There are significant gaps in global surveillance

Figure 2 Availability of data on resistance for selected bacteria–antibacterial drug combinations, 2013



Number of reported bacteria is based on the information obtained based on request to national official sources on antibacterial susceptibility testing of at least one of the requested combinations, regardless of denominator data.
Data from United Arab Emirates originate from Abu Dhabi only.

- Many countries are reporting AMR data on less than 5/9 WHO microbes of international concern.
- Some of best data on AMR is from disease-specific programmes (e.g. TB).

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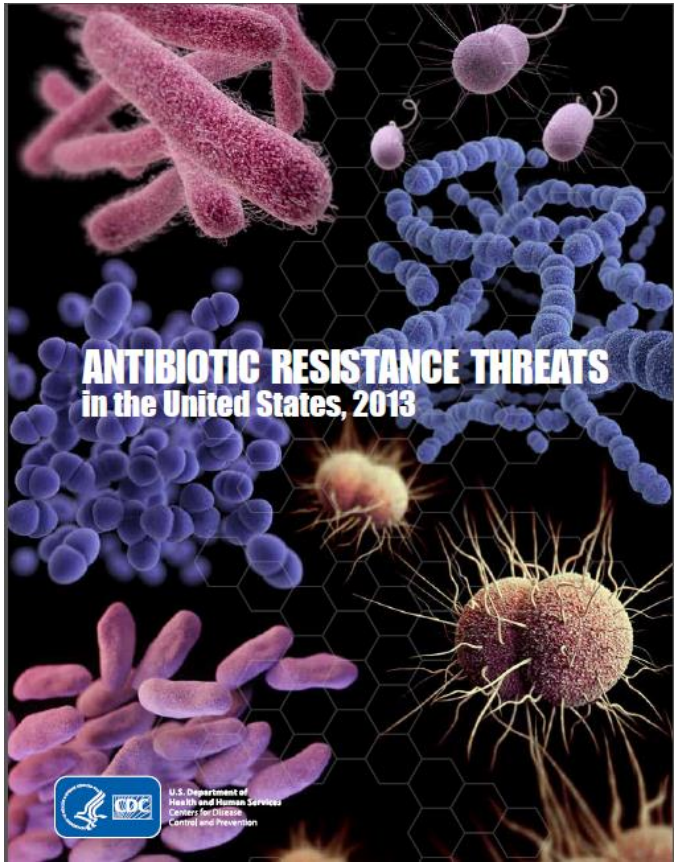
AMR in the United States



HAZARD LEVEL URGENT

These are high-consequence antibiotic-resistant threats because of significant risks identified across several criteria. These threats may not be currently widespread but have the potential to become so and require urgent public health attention to identify infections and to limit transmission.

Clostridium difficile (C. difficile); Carbapenem-resistant Enterobacteriaceae (CRE), Drug-resistant *Neisseria gonorrhoeae* (cephalosporin resistance)

HAZARD LEVEL SERIOUS

These are significant antibiotic-resistant threats. For varying reasons (e.g., low or declining domestic incidence or reasonable availability of therapeutic agents), they are not considered urgent, but these threats will worsen and may become urgent without ongoing public health monitoring and prevention activities.

Multidrug-resistant *Acinetobacter*, Drug-resistant *Campylobacter*, Fluconazole-resistant *Candida* (a fungus), Extended spectrum β-lactamase producing Enterobacteriaceae (ESBLs), Vancomycin-resistant *Enterococcus* (VRE), Multidrug-resistant *Pseudomonas aeruginosa*, Drug-resistant Non-typhoidal *Salmonella*, Drug-resistant *Salmonella* Typhi, Drug-resistant *Shigella*, Methicillin-resistant *Staphylococcus aureus* (MRSA), Drug-resistant *Streptococcus pneumonia*, Drug-resistant tuberculosis (MDR and XDR)

HAZARD LEVEL CONCERNING

These are bacteria for which the threat of antibiotic resistance is low, and/or there are multiple therapeutic options for resistant infections. These bacterial pathogens cause severe illness. Threats in this category require monitoring and in some cases rapid incident or outbreak response.

Vancomycin-resistant *Staphylococcus aureus* (VRSA), Erythromycin-resistant *Streptococcus* Group A, Clindamycin-resistant *Streptococcus* Group B

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Antibiotic (mis)use drives resistance

Global: 36% increase in consumption of antibiotic drugs (2000-2010)
- increased consumption of carbapenems (45%)

Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data

Thomas P Van Boeckel, Sumanth Gandra, Ashvin Ashok, Quentin Caudron, Bryan T Grenfell, Simon A Levin, Ramanan Laxminarayan

Lancet Infect Dis 2014; 14:742–50

Published Online July 10, 2014 http://dx.doi.org/10.1016/

Summary

Background Antibiotic drug consumption is a major driver of antibiotic resistance. Variations in antibiotic resistance across countries are attributable, in part, to different volumes and patterns for antibiotic consumption. We aimed to assess variations in consumption to assist monitoring of the rise of resistance and development of rational-use policies and to provide a baseline for future assessment.

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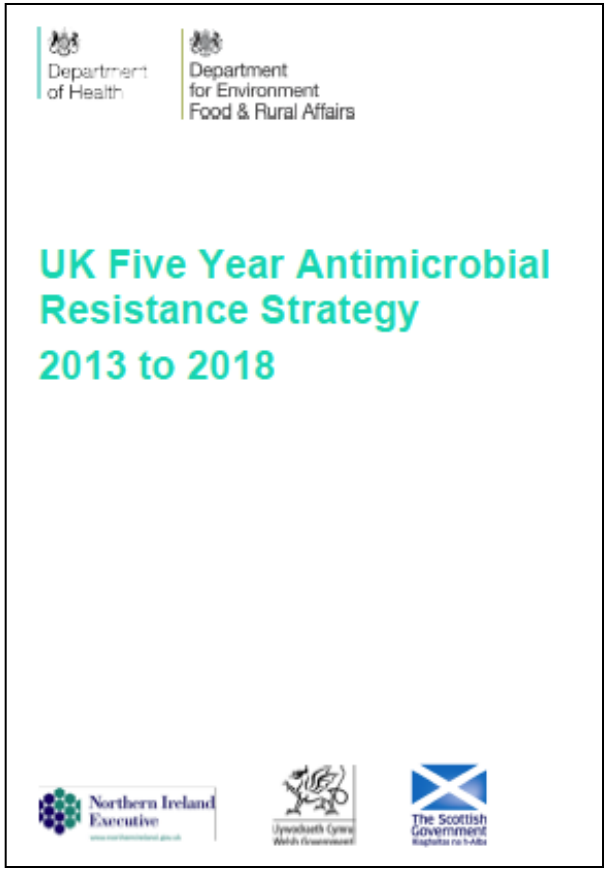
UK 5-year AMR Strategy 2013 -18

CMO Annual Report 2011*

*published: March 2013

'One Health'



Strategic aims

1. Improve the knowledge and understanding of AMR
2. Conserve and steward the effectiveness of existing treatments
3. Stimulate the development of new antibiotics, diagnostics and novel therapies

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National actions (Surveillance)

J Antimicrob Chemother 2013; **68**: 2421–2423
doi:10.1093/jac/dkt363 Advance Access publication 11 September 2013

Journal of Antimicrobial Chemotherapy

Antimicrobial stewardship: English Surveillance Programme for Antimicrobial Utilization and Resistance (ESPAUR)

Diane Ashiru-Oredope* and Susan Hopkins on behalf of the English Surveillance Programme for Antimicrobial Utilization and Resistance Oversight Group†

Healthcare Associated Infection, Antimicrobial Resistance and Stewardship (HCAI and AMRS) Programme, Public Health England, London SE1 8UG, UK

*Corresponding author. Tel: +44-20-8327-6689; E-mail: diane.ashiru-oredope@phe.gov.uk
†Members of the ESPAUR Oversight Group are listed in the Acknowledgements.

First ESAPUR report to be published in October 2014

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Summary of 2014 ESPAUR Report

Antibiotic resistance is a key threat to everyone's health and modern medical care.

In England

- **The number of patients with bloodstream infections has increased each year, 2010 to 2013 (e.g. 12% for E.coli)**
- **Increased numbers of these bloodstream infections are caused by resistant bacteria, 2010 to 2013**
- **Antibiotic prescribing to patients has increased by 6% between 2010 to 2013 (GP 4% rise; Hospital 12% rise)**
- **Almost 80% of antibiotics are prescribed by General Practices**
- **Significant variability of resistance and antibiotics prescribing**
- ***Concerning data for resistance and prescribing in England***

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Significant regional prescribing variation

General Practice

- Durham, Darlington and Tees, which was over 40% higher than London
- 26.5 compared to 18.9 DDD per 1000 Inhabitants per Day (DID)

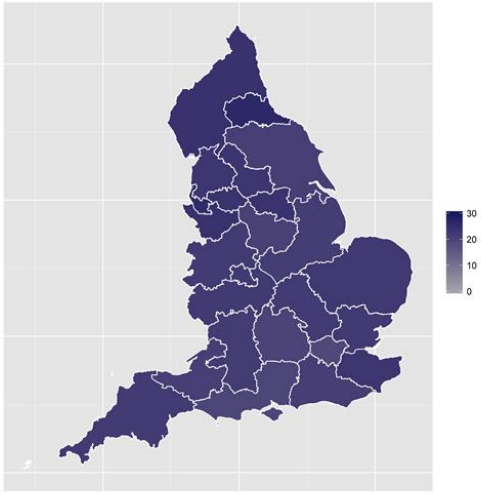
Hospital

- London twice Leicestershire and Lincolnshire
- 6.0 DID compared to 2.9 DID

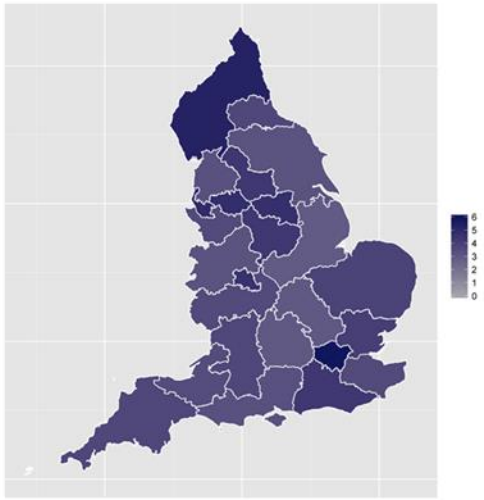
Total

- Merseyside, highest (similar to Southern Europe) over 30% higher Thames Valley
- 30.4 DID compared to 22.8 DID

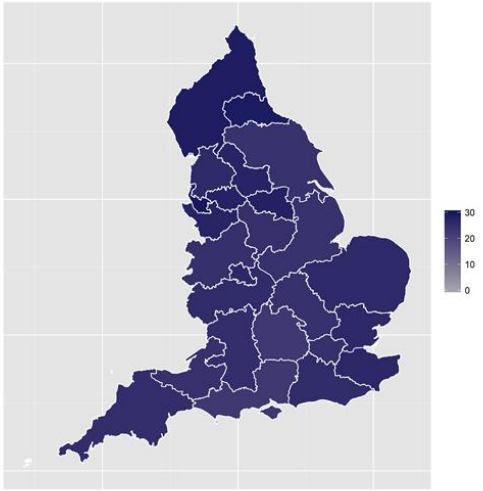
General Practice consumption by ATs, England, 2013



Hospital consumption, by ATs, England, 2013



Total consumption, by ATs, England, 2013



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Global action on AMR

- **World Health Assembly 2014 resolution**
- **Global Health Security Agenda: AMR action package** - *mechanism and collaboration to accelerate implementation*
- **WHO Global AMR Action Plan 2015** – *framework for action*

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René Descartes (31 March 1596 – 11 February 1650)

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Immanuel Kant (22 April 1724 – 12 February 1804)

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John Stuart Mill (20 May 1806 – 8 May 1873)

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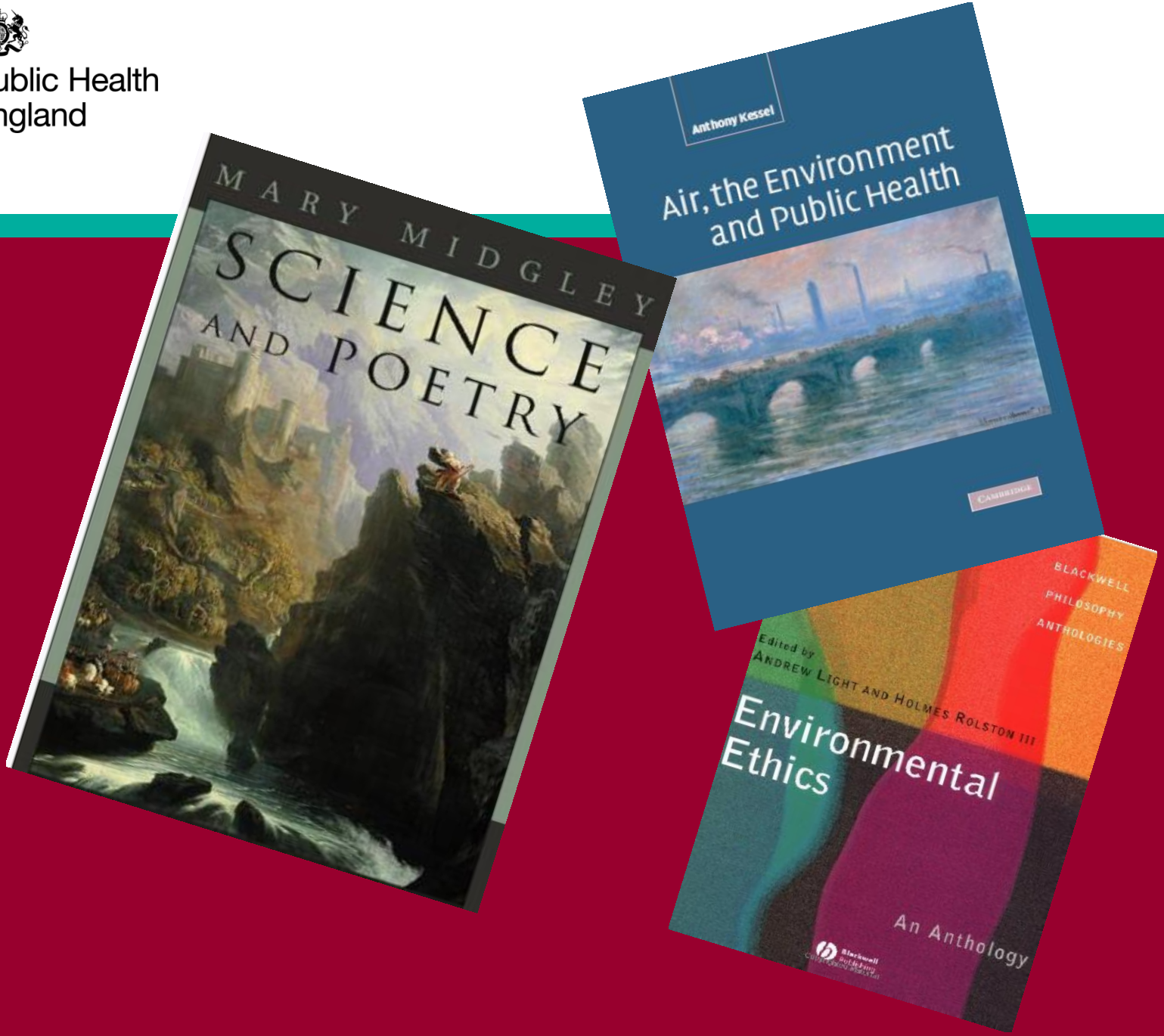

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Environmental philosophy

INSTRUMENTAL VALUE (moral worth)

VS

INTRINSIC / INHERENT VALUE (moral worth)

"Natural capital refers to the elements of nature that produce value (directly and indirectly) to people, such as the stock of forests, rivers, land, minerals and oceans. It includes the living aspects of nature (such as fish stocks) as well as the non-living aspects (such as minerals and energy resources). Natural capital underpins all other types of capital… and is the foundation on which our economy, society and prosperity is built."

- The Natural Capital Committee

Climate change is here now and it could lead to global conflict

Extreme weather events in the UK and overseas are part of a growing pattern that it would be very unwise for us, or our leaders, to ignore, writes the author of the influential 2006 report on the economics of climate change

Nicholas Stern
The Guardian, Friday 14 February 2014

Jump to comments (1419)

Refugees queue for food parcels in Yarmouk, Syria. Photograph: Handout/Reuters

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Conclusions

- **AMR a significant, (super)wicked, global issue**
- **Antibiotics are an invaluable societal resource**

BUT

- **Truly tackling AMR necessitates a re-conceptualisation of the natural environment as having inherent value and, therein, lies the future direction of public health**