Pharmaceutical Pollution and Water Quality

Alistair B A Boxall
Environment Department
Email: alistair.boxall@york.ac.uk
Twitter: @alistairboxall
A significant contributor to pharmaceutical use - around 290 tonnes of antibiotics are used in veterinary medicine each year in the UK + large amounts of parasiticides
Manufacturing emissions also an issue

Ciprofloxacin concentrations up to 31 mg/l seen in manufacturing areas in India (Larsson et al., 2007)
Global occurrence of pharmaceuticals

Aus der Beek et al., 2016
Sulfonamides
Tetracyclines
Fluoroquinolones
Lincosamides
Carbamazepine
Triclosan
Monitoring for 88 pharmaceuticals across the River network in York
Thirty Six Pharmaceuticals Detected

Burns et al., ET&C in press
Drug receptors

Many receptors conserved in organisms in the natural environment.
Diclofenac and Vultures

‘Nine species of vultures in the wild numbered 40 million birds in the early 1980s. Today, only about 60,000 birds are left’ (Vibhu Prakash)
Indirect impacts on humans

- diclofenac use in livestock
- decline in vulture population
- increase in feral dog population
- increase in dog bites of humans
- increase in incidence of rabies
- 45000 extra human deaths

Adapted from Markandya et al 2009
Effects of oxazepam on fish

A near environmentally relevant concentration made fish more active and bold and reduced feeding and made fish less social (Brodin et al., 2013)
45% of UK river reaches have levels of ibuprofen shown to affect fish hatching; 4.5% have levels of diclofenac shown to affect fish histology (Boxall et al., 2014)
Food Chain Impacts

Exposure of starlings to antidepressants in sewage works could be affecting bird feeding behaviour (Bean et al., 2014)
Antibiotics, Primary Production and Resistance

Concentrations of antibiotic mixtures hundreds of times higher than those known to affect algae (Guo et al., 2016); resistance selection also possible (Wellington et al., 2013)
Parasiticides and invertebrates

Concentrations of veterinary parasiticides in runoff water 12,000 x higher concentrations that affect reproduction
Approaches to manage risk

- More targeted and environmentally friendly pharmacology
- Change usage behaviour
- Improve wastewater treatment
- Management of hospital emissions
- Take back schemes
- *In situ* treatment systems
Integrated Management Approach
Summary

• Major concerns over pharmaceuticals in the environment
• A significant proportion of river reaches in the UK may be at risk so some compounds require further scrutiny
• Impacts on wildlife also possible
• A range of management options available - there is a need for an integrated approach
• Still many open questions
Acknowledgements

NERC
Science of the Environment

IMI
Innovative Medicines Initiative

EU
Flag

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Driving Innovation

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DWI

BBSRC
Bioscience for the Future

PyroPure
References


