Adverse impact of Pharmaceuticals in developing countries

Naresh Gupta
Tushar K Joshi

New Delhi, INDIA
Vultures in India

Vultures previously played an important role in public sanitation in India.
Vultures in India

Nine species of vultures in India, most now in danger of extinction.

1980: ~ 80 million white-rumped vultures (*Gyps bengalensis*) in India, the most numerous species of raptor in the world.

Now: only several thousand

“the fastest population collapse of any bird species in recorded history”
• *Nature* 12 February 2004

Diclofenac residues as the cause of vulture population decline in Pakistan

*J. Lindsay Oaks, Martin Gilbert, Munir Z et al*

...Starting Keoladeo National Park, India in 1990s

*Diclofenac induced From renal failure n visceral gout*
Vultures in India

• Their disappearance has resulted in an explosion of rats and wild dogs;
• the spread of diseases including anthrax, rabies, and plague;
• a public health crisis; and a total cost of up to 34 billion $
Fig. 2 Box plot showing the median, upper (green) and lower (red) quartiles, 95% confidence intervals (error bars), and highest observed levels (red crosses) of NSAIDs in surface water from three Indian rivers.
The effects of these NSAIDs...

Both the drugs Clofibric and Diclofenc caused

- Significant changes in biochemical & iono-regulatory responses of fish at all concentrations.

- Alterations of these parameters can be useful in monitoring of pharmaceutical residues present in aquatic environment.

Manoharan Saravanan • Mathan Ramesh
Alteration in certain enzymological parameters of an India major carp, Cirrhinus mrigala exposed to short and longterm exposure of clofibric acid and diclofenac

“In both short- and long-term exposure, a significant (P< 0.01 and P<0.05) changes were observed in all enzymological parameters of fish C. mrigala exposed to different concentrations of CA and DCF. The alterations of these enzymological parameters can be effectively used as potential biomarkers in monitoring of pharmaceutical toxicity in aquatic environment and organisms.

Fish Physiol Biochem (2013) 39:1431–1440

Manoharan Saravanan • Mathan Ramesh • Rakpong Petkam, School of Life Sciences, Bharathiar University, Coimbatore 641 046, Tamil Nadu, India
Delhi neighborhood

• All the six **drugs** (ibuprofen, ketoprofen, naproxen, diclofenac, carbamazepine, trimethoprim) were detected in wastewater of Ghaziabad, whereas naproxen was not detected in Lucknow wastewater.

• Levels were relatively higher in Ghaziabad as compared to those in Lucknow

• Diclofenac was the most frequently detected drug in both the study areas.

• Detection of these **drugs** in wastewater reflects the importance of wastewater inputs as a source of pharmaceuticals.
Spatiotemporal distribution of nine pharmaceuticals in Chinese tap water. Abbreviations: D, dry season; W, wet season.
Pharmaceuticals in Tap Water
Pharma Drugs into Environment - Extent of impact

- Population crash/imbalance
- Superbugs
- Disappearing males
Fear of the unknown...

- Poly-pharmaceutical interactions

- No water standards for pharmaceuticals?
Global problem

• 631/713 instances had detectable levels in EU

• Most of the 160 sewage treatment works (UK) had high levels of common drugs- NSAIDs, Antimicrobials, Oestrogens...

• Globally, 71 countries have contaminated surface/ ground/drinking water, soil/ manure
Pharmaceuticals into Environment

Consumers (90%)

Disposal & Treatment systems

Producers
Pharma Power

- $1.24 trillion in 2014
- Asia-Pacific 2\textsuperscript{nd} highest contributor
- Sharing of developing countries doubled in 10 yrs
- India- highest pill-popping country!
The Issue

Who is

How to bell the cat....

... in developing countries?
Avian scavengers and the threat from veterinary pharmaceuticals

Richard J. Cuthbert1,2, Mark A. Taggart3, Vibhu Prakash4, Soumya S. Chakraborty4, Parag Deori4, Toby Galligan1, Mandar Kulkarni4, Sachin Ranade4, Mohini Saini5, Anil Kumar Sharma5, Rohan Shringarpure4 and Rhys E. Green1,6

1Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire SG19 2DL, UK
2Wildlife Conservation Society, PO Box 277, Goroka, Eastern Highlands Province, Papua New Guinea
3Environmental Research Institute, University of the Highlands and Islands, Thurso KW14 7JD, UK
4Bombay Natural History Society, Hornbill House, S.B. Singh Road, Mumbai 400 001, India
5Centre for Wildlife Conservation, Management and Disease Surveillance, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh 243 122, India
6Conservation Science Group, Department of Zoology, University of Cambridge, Downing St., Cambridge CB2 3EJ, UK

Veterinary use of the non-steroidal anti-inflammatory drug diclofenac on domesticated ungulates caused populations of resident Gyps vultures in the Indian sub-continent to collapse. The birds died when they fed on carrion from treated animals. Veterinary diclofenac was banned in 2006 and meloxicam was advocated as a ‘vulture-safe’ alternative. We examine the effectiveness of the 2006 ban, whether meloxicam has replaced diclofenac, and the impact of these changes on vultures. Drug residue data from liver samples collected from ungulate carcasses in India since 2004 demonstrate that the prevalence of diclofenac in carcasses in 2009 was half of that before the ban and meloxicam prevalence increased by 44%. The expected vulture death rate from diclofenac per meal in 2009 was one-third of that before the ban. Surveys at veterinary...
Cleaning the Delhi Air

• CNG Delhi – the world’s cleanest public bus system running on CNG

• Between 2000 and 2008, the Carbon emissions plummeted by 72%, while the SO2 emissions decreased by 57% [WWF and E3G, Nov 2009]
  – 10,000 buses, 12000 taxis, 65000 auto rickshaws (tuk-tuks) and 5000 mini buses plying on CNG

PIL- the magic pill

Public Interest Litigation
Cleaning the Delhi Air

• In a decade, it worsens again!
  – Private vehicles
  – Commercial vehicles passing through Delhi

• Limit the life
  – 10/15 years for commercial/private vehicles

• Pollution Tax
“Cheshire Puss, Would you tell me, please, which way I ought to go from here?”

“That depends a good deal on where you want to get to.”

“I don’t much care where —" said Alice."

“Then it doesn’t matter which way you go.”

—Lewis Carroll, Alice in Wonderland

http://trangsblog.blogspot.in/2010/05/alice-in-wonderland.html