



HOW DOCTORS CAN HELP

reduce
pharmaceutical
pollution



HOW DO PHARMACEUTICALS GET IN THE ENVIRONMENT?



Aside from manufacturing, **two ways** pharmaceuticals can get in the environment are through improper disposal (in sinks and toilets) and human excretion. Wastewater treatment plants are unable to completely filter the improperly disposed of pharmaceuticals and residual pharmaceuticals found in human excretions. These residues can re-enter the water supply and spread to other environmental compartments, such as surface waters and agricultural lands.

1 Patients consume and excrete medicine

30-90% Between 30-90% of an oral dose can be excreted as an active substance in urine (1).

30% 30% of active pharmaceutical ingredients have low bioavailability (2).

2 Patients dispose of medicine in toilets and sinks

£300m Each year in the UK alone, an estimated £300m (around €375m) worth of dispensed medicines go unused and are ultimately discarded (3).

50% An estimated 50% of unused pharmaceuticals are not collected in the EU (1).

Therapeutic classes that can have harmful effects on unintended organisms:

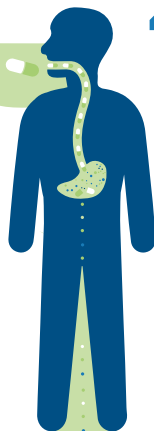
- Cytostatics that are cytotoxic by design
- Antibiotics that pose a risk of promoting antimicrobial resistance
- Synthetic hormones that can act as endocrine disruptors
- Anti-inflammatory drugs and sedatives that are consumed in large quantities

There is a large number of pharmaceuticals on the market and consumption is increasing

3.000 There are approximately 3.000 active pharmaceutical ingredients available on the EU market (1).

2nd The EU is the second largest consumer of pharmaceuticals in the world (1).

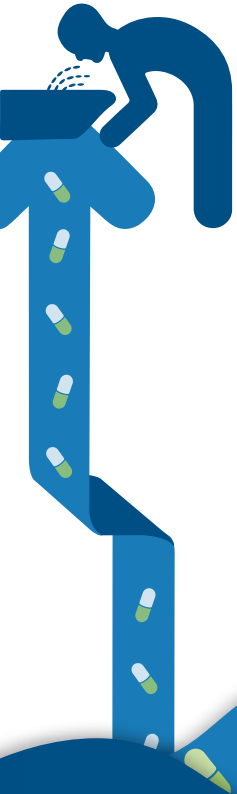
→ **Common patient disposal practices:** toilet, sink and household rubbish.



HOW ARE HUMANS EXPOSED TO PHARMACEUTICALS IN THE ENVIRONMENT?

Pharmaceutical residues that re-enter the water supply and spread to surface waters and agricultural lands can ultimately end up in drinking water and accumulate in vegetables and fish. Humans can be unintentionally exposed by consuming contaminated water and food. Low concentrations of pharmaceuticals in the environment can have adverse effects on animals and other organisms, which raises questions about how humans can be affected by continuous, long term exposure to low concentrations of pharmaceuticals.

Drinking water can contain pharmaceuticals



- Up to 25 different pharmaceuticals and their metabolites have been detected in drinking water around the world (4).
- Lipid-lowering and analgesic drugs have been found in drinking water in Germany (5).
- Anti-epileptic and anti-hypertensive drugs have been found in drinking water in Italy (6).
- Antibiotic, antiepileptic and beta-blocking drugs have been found in drinking water in the Netherlands (7).

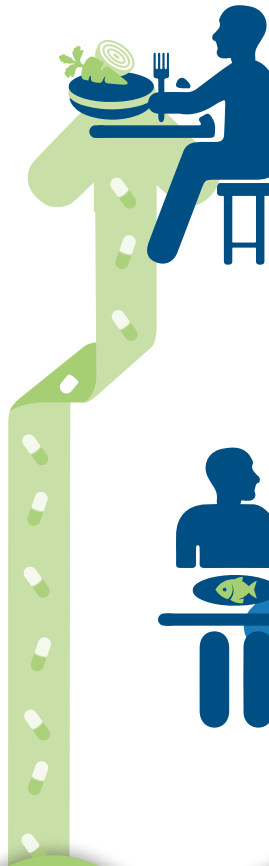
But isn't water filtered?

80% Sewage treatment plants generally remove only 80% of pharmaceuticals and their metabolites (8).

10% Even using the most advanced treatment methods, 10% of pharmaceuticals remain after water has been treated (8).

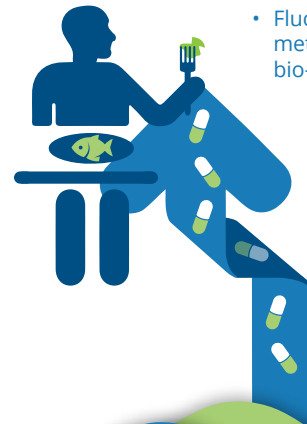
600+ More than 600 pharmaceuticals have been detected in sewage treatment effluents, sludge, groundwater, surface waters and biota across the globe (9).

Vegetables can take up pharmaceuticals from water and sludge



- Some countries in Europe use wastewater for irrigation and wastewater sludge to fertilise agricultural land (10).
- Carrots and lettuce have shown the ability to take up quinolones from soil treated with manure (11).
- Carbamazepine has been shown to concentrate in root tissues and translocate to above-ground parts in soybeans irrigated with reclaimed water (12).

Fish can bio-accumulate pharmaceuticals



- Fluoxetine, sertraline and other metabolites have been found to bio-accumulate in fish (13).

HOW CAN PHARMACEUTICALS IN THE ENVIRONMENT AFFECT WILDLIFE?

Though the traces of pharmaceuticals in the environment are well below therapeutic doses, they can still have effects on unintended targets. Animals and other organisms that are exposed to pharmaceuticals in water, soil, or even by feeding on medicated animals can experience behavioural, physiological and histological effects. Antibiotics in the environment can promote the development of antibiotic-resistant pathogens.

“Resistant pathogenic microorganisms need to develop only once at a single site. Then, heavy drug use, insufficient hygiene and extensive travel habits often take care of their spread.”

PROF JOAKIM LARSSON (14)

Field and laboratory studies have shown that pharmaceuticals in the environment can cause:

- **REPRODUCTION PROBLEMS** - Synthetic oestrogens in water can inhibit reproduction in amphibians and fish, including rainbow trout (16).
- **RENAL FAILURE** - Anti-inflammatory drugs can cause renal failure in birds (17).
- **INTERFERENCE WITH PREDATOR AVOIDANCE BEHAVIOUR** - Fluoxetine can raise assertiveness in fathead minnows thus making them more vulnerable to predators (18).
- **DEVELOPMENT OF ANTIBIOTIC-RESISTANT PATHOGENS** - The presence of antibiotics in the environment can promote antibiotic resistance (14).

→ **A recent study shows that pharmaceuticals are able to pass to higher trophic levels through the food chain:**

17

pharmaceuticals were found in water

8

pharmaceuticals were found in fish

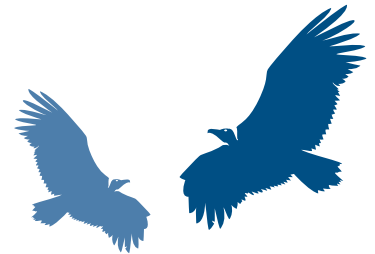
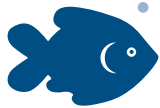
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pharmaceutical was found in birds feeding on the contaminated fish (19).

→ **Since 1979, studies have continued to find a link between synthetic hormones in waters and the development of female characteristics in male fish (15).**

95%

In Pakistan, 95% of the Gyps vulture population died from renal failure after feeding on the carcasses of cattle treated with diclofenac (20).



WHAT IS CURRENTLY BEING DONE AT THE EU LEVEL TO ADDRESS PHARMACEUTICAL POLLUTION?

Labelling requirements

The outer packaging of medicinal products must list specific precautions relating to disposal and reference to any appropriate collection system in place (20).

Collection systems for unused medicinal products

Countries of the European Union must ensure that appropriate collection systems are in place for unused or expired medicinal products (21).

Water monitoring

Diclofenac and two synthetic oestrogens are included on the Watch List of substances subject to EU-wide monitoring under the Water Framework Directive (22).

Strategic approach

By autumn 2015 the European Commission will develop a strategic approach to the pollution of water by pharmaceuticals. In autumn 2017, the Commission will propose measures to reduce the environmental impacts of pharmaceuticals (22).

HCWH Policy suggestions

HCWH is advocating for upstream, preventative solutions to address pharmaceutical pollution:

- raising public awareness
- improving the implementation and enforcement of pharmaceutical collection systems
- optimising use of the environmental risk assessment for pharmaceuticals
- promoting the development green and sustainable pharmaceuticals

HIGHLIGHT ON REGIONAL PRACTICE: *Stockholm County Council's Wise List*

The Stockholm County Council (SCC) is proactively addressing pharmaceutical pollution as part of its preventative environmental health work at the regional level. Among other initiatives, the SCC has developed an environmental classification of pharmaceuticals. This classification, which includes around 700 pharmaceutical substances, is available online and in booklet form and can be used by experts when deciding which medicines to include in formularies or guidelines.

SCC uses the classification to develop recommendations for the "Wise List", a formulary of essential medicines for patient care in the Stockholm county. Although the Wise List primarily focuses on medical benefits and side effects, when multiple pharmaceuticals have the same benefits, the environmental classification can be considered.

Use of the Wise List is not mandatory but more than 80% of the prescribed pharmaceuticals within the SCC are in accordance with the recommendations in the Wise List.

For more information, visit <http://www.janusinfo.se/In-English/>



HOW CAN DOCTORS HELP REDUCE PHARMACEUTICAL POLLUTION?

Doctors control the duration and dosage of individual prescriptions, and are well positioned to help reduce the risk for accumulation of unused pharmaceuticals that become waste and can end up in the environment.

Simple practices can help reduce unnecessary pharmaceutical emissions in the environment:

- ✓ Prescribing starter packs for new medicines
- ✓ Prescribing the smallest package possible, and giving refills as needed
- ✓ Prescribing preventative measures and non-medical therapy where possible
- ✓ Prescribing antibiotics prudently

Reducing unused medicine can also:

- ✓ Reduce healthcare costs
- ✓ Reduce loss of patient benefits
- ✓ Optimise use of healthcare resources
- ✓ Be part of your hospital's or clinic's sustainability strategy



Doctors can also help educate patients about pharmaceutical pollution and on ways to reduce waste and unnecessary emissions.

Simple reminders to patients can improve their buying and disposal behaviour:

- ✓ Reminding patients to buy over-the-counter medicine only as needed and to avoid stockpiling medicines that cannot be used before expiry
- ✓ Advising patients to never dispose of unused pharmaceuticals in the toilet or sink
- ✓ Advising patients on the safe, local recommended method for disposing of pharmaceuticals and packaging

Educating patients can also:

- ✓ Reduce the accumulation of unused medicines
- ✓ Improve public awareness of pharmaceutical pollution and waste
- ✓ Reduce incidences of abuse and poisoning



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Health Care Without Harm (HCWH) Europe is a non-profit European coalition of over 70 hospitals, healthcare systems, healthcare professionals, local authorities, research/academic institutions and environmental and health organisations.

HCWH Europe works to transform the health sector so that it becomes ecologically sustainable and a leading advocate for environmental health and justice across the globe.

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References

1. BIO Intelligence Service. 2013.
2. Kummerer K. 2009.
3. York Health Economics Consort. 2010.
4. WHO. 2012.
5. Heberer T et al. 1997.
6. Huerta-Fontela et al. 2011.
7. Mons M et al. 2003.
8. EurEau. 2014.
9. Kuester A, Adler N. 2014.
10. Schmidt W, Redshaw CH. 2014.
11. Boxall ABA et al. 2006.
12. Wu C et al. 2010.
13. Brooks BW et al. 2005.
14. Larsson DGJ. 2007.
15. Jobling S et al. 1998.
16. Arnold KE et al. 2014.
17. Cuthbert R et al. 2007.
18. Kidd KA et al. 2007.
19. Lazarus RS et al. 2014.
20. Oaks JL et al. 2004.
21. DIRECTIVE 2001/83/EC
22. DIRECTIVE 2013/39/EU