PRESS RELEASE

A classification of drugs based on their environmental impact

Scientists at UNIL and Unisanté classified 35 commonly used drugs in Switzerland based on their impact on the aquatic biodiversity. The aim of this research is to provide medical staff with a tool for considering the environmental risks associated with certain common drugs when prescribing them. The proposed list is subject to change when new data become available, their rarity being a limiting factor for classification.

Every day in Western countries, thousands of drugs are consumed, whether to relieve pain, regulate blood pressure or treat infections. But what happens after ingesting these products? Evacuated via urine, many substances end up in wastewater. They are only partially eliminated by these systems, and end up in lakes, rivers and streams, posing a risk to aquatic ecosystems. This risk is now recognized, but it is difficult for doctors to know how to integrate it into their practice.

At the University of Lausanne (UNIL), scientists from the Faculty of Biology and Medicine (FBM) and the Faculty of Geosciences and Environment (FGSE) have carried out an unprecedented classification of widely used drugs according to their ecotoxicity, i.e. their danger to the aquatic ecosystem. Published in the *International Journal of Environmental Research and Public Health*, the study reveals that drugs commonly prescribed in general medicine - to combat inflammation or infection, for example - have significant consequences for the health of fish, algae and bacteria essential to aquatic biodiversity.

Painkillers and antibiotics among the most problematic

The researchers classified 35 drugs commonly consumed in Switzerland into categories ranging from low to high toxicity for aquatic ecosystems. To do this, they cross-referenced three pieces of information: the 50 most widely sold drugs in Switzerland (by weight), those for which ecotoxicity thresholds exist, and the concentration of those found in the rivers of Vaud and Lake Geneva (in the form of active ingredient).

Among the most problematic drugs are common painkillers and anti-inflammatories such as diclofenac, which is toxic to fish liver and can lead to fish death. There are also antibiotics such as ciprofloxacin, which can eliminate bacteria useful to the ecosystem's balance, and encourage the emergence of antibiotic-resistant bacteria. Mefenamic acid and paracetamol, on the other hand, are in the category with the lowest environmental risks.

One Health: Protecting Both People and the Planet

“This classification is far from complete, because of the lack of data. It does, however, give some initial indications for practitioners,” comments Nathalie Chèvre,

ecotoxicologist at the FGSE and co-director of the study. “Of the 2000 or so drugs on the European market, we have only classified 35. This is a good start, but more ecotoxic thresholds need to be established and accepted to enable us to continue this kind of analysis”, adds Tiphaine Charmillot, a researcher at the FBM and at Unisanté, and first author of the article.

In Switzerland, new treatments are being introduced at WWTPs, with promising results. “However, they are costly both economically and ecologically,” says Nathalie Chèvre. “Nor does it solve the problem of poor connections and wet-weather discharges. So, it's always preferable to fight at source."

In the meantime, the scientists hope that this approach, which represents a first step, will encourage the integration of environmental considerations into therapeutic choices, as is already advocated within the framework of various initiatives such as “smarter medicine - Choosing Wisely Switzerland”. The idea is to control the environmental impact of healthcare professionals' practices, while offering the best possible quality of care.

In practice, this could mean using this classification to prioritize the least harmful option when prescribing medication, in cases where two treatments have the same therapeutic efficacy - for example, favoring the use of mefenamic acid over diclofenac for the treatment of pain; avoiding unnecessary prescriptions, such as antibiotics for non-bacterial infections (e.g., colds); and finally, proposing non-pharmacological approaches where possible (treatment of chronic pain by physiotherapy or behavioral therapy; treatment of mild depression by phytotherapy, etc.). “The concept of health should encompass human health, the health of all living things and the health of the natural environment,” explains Nicolas Senn, a researcher at FBM and at Unisanté, and co-director of the study. “Eco-responsible medicine also benefits patients directly, by avoiding over-medication, but also indirectly, by promoting a healthier environment, which is essential for well-being”.

Source: T. Charmillot, N. Chèvre, N. Senn, *Developing an Ecotoxicological Classification for Frequently Used Drugs in Primary Care*, International Journal of Environmental Research and Public Health, 2025

Drug classification*, overview of results:
***The word "drug" is used here to refer to the active ingredients of the drug.**

High to very high-risk level for aquatic life and ecosystems:

- Antibiotics (clarithromycin, azithromycin, ciprofloxacin, sulfamethoxazole)
- Painkiller, anti-inflammatory (diclofenac, ibuprofen)
- Antiepileptic, mood stabilizer (Carbamazepine)
- Iodinated contrass agent (iopromide, iomeprol)

Moderate environmental for aquatic life and ecosystems:

- Antibiotics (clindamycin, erythromycin, metronidazole, trimethoprim)
- Antidepressant (venlafaxine)
- Painkiller, anti-inflammatory (ketoprofen, mefenamic acid, naproxen)
- Beta-blocker (metoprolol, propranolol, sotalol)

Low to Very Low Environmental Risk for aquatic life and ecosystems:

- Antibiotics (ofloxacin, sulfadiazine)
- Antidepressant (amisulpride, citalopram, mirtazapine)
- Antidiabetic (metformine)
- Painkiller (paracetamol, tramadol)
- Antiepileptic (gabapentin, lamotrigin, primidone)
- Anti-hypertensive (candesartan, irbesartan)
- Betablocker (atenolol)
- Diuretic (hydrochlorothiazid)

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