

Forum: United Nations Environmental Program (UNEP)

Issue: Measures to address the effects of environmental persistent
Pharmaceutical pollutants

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Introduction

Pharmaceuticals are pills designed to work on living organisms and their cells. They have several functions but are not limited to changing the signals of cells, regulating hormonal balances, and the way cells metabolize nutrients. Because these pharmaceuticals are designed to pass through the stomach acid to reach the final destination they are designed to degrade very slowly or not at all. When these pharmaceuticals enter the environment directly or indirectly, they are known as environmental persistent pharmaceutical pollutants (PPPs). Indirectly consists of animal or human feces and direct is the disposal of pharmaceutical industries or unused medicines from medical facilities. The consequences faced due to persistent pharmaceutical pollutants entering the environment are stimulating the growth of already existing microorganisms, DNA mutations, and detrimental health consequences for animals. However, Pharmaceuticals are crucial for human existence, and their well-being. Various first-world countries such as Poland, Germany, and the United States have the largest markets and manufacturing facilities for pharmaceuticals in the world, nevertheless, we should ask if this is a benefit or a complication.

Definition of Key Terms

Pharmaceuticals

A substance created for use as a medicinal drug.

Environmental persistent pharmaceutical pollutants (EPPP)

Pharmaceuticals are made to pass through stomach acid and decay slowly or not at all before reaching their final destination. Environmental persistent pharmaceutical pollutants are defined as medications that infiltrate the environment either directly or indirectly (PPPs). They then have a harmful impact on the environment.

Synthetic chemicals

Chemicals created by humans using methods that differ from those used by nature, and these chemical structures may or may not exist in nature.

Endocrine disruptors:

This is a substance that disrupts the endocrine system's normal function, as well as the reproductive and other biological processes that it controls.

Aquafarming:

Plant and animal cultivation in freshwater and marine environments for human consumption or use.

Oestrogen:

Any of a group of steroid hormones that aid in the development and maintenance of female physical features. Artificially generated hormones are also used in oral contraceptives and to treat menopausal and menstrual diseases.

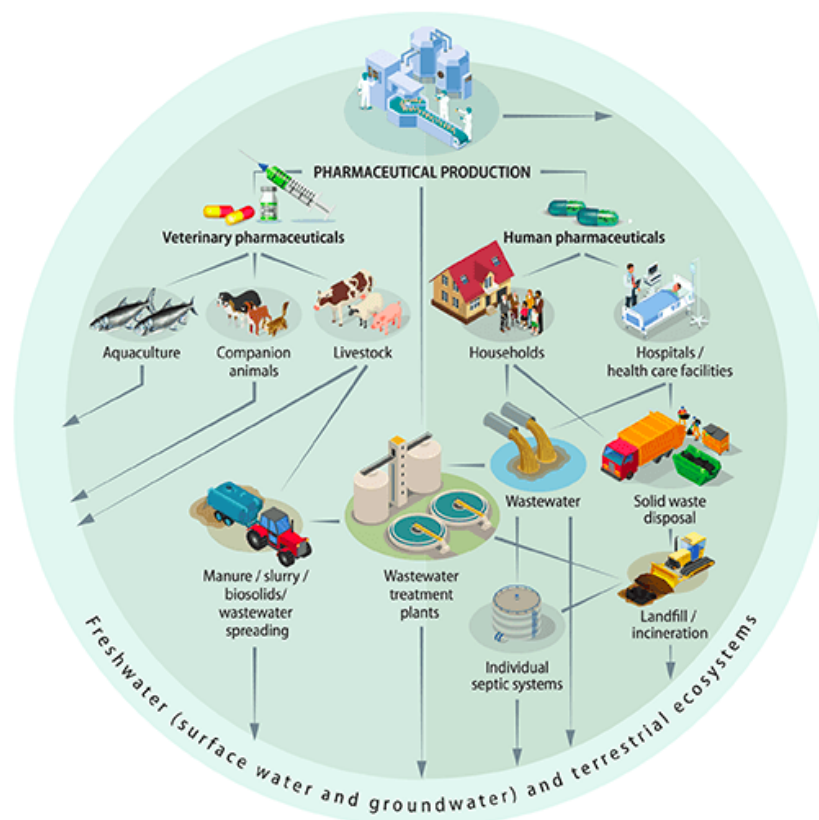
Biomagnification:

Toxin concentration in an organism as a result of consuming other plants or animals with more widely dispersed toxins.

General Overview

The problem in-depth

Chemicals are essential in the medical field. They can be utilized as cleaners, laboratory reagents, disinfectants, sterilants, pharmaceuticals, medical devices, and equipment, and they provide significant animal welfare benefits. Nonetheless, there is a growing awareness and worry about the harm that poorly managed pharmaceuticals and chemicals can do to human health and the environment. Pharmaceuticals are active biological compounds that are particularly designed to elicit pharmacological effects in living animals. When they are not treated in an environmentally sound manner, they have an influence on wildlife and ecosystem health. When looking at a chemicals and waste management perspective, environmental and health concerns in their sector are primarily related to releases of pharmaceuticals into the environment. The waste is dumped into rivers, aquifers, and lakes. When used in animal husbandry and when manure is used as a fertilizer, veterinary drugs are released into the soil and larger environment. This pollutes the soil and produces biomagnification as pharmaceuticals are absorbed by food crops. Direct emissions from pharmaceutical manufacturing, patient and animal excretion, disposal of unused/ expired drugs, and aquafarming are all sources of pharmaceutical releases into the environment. The main issue is what these environmental persistent pharmaceutical pollutants do to the environment and how the UNEP can stop this.

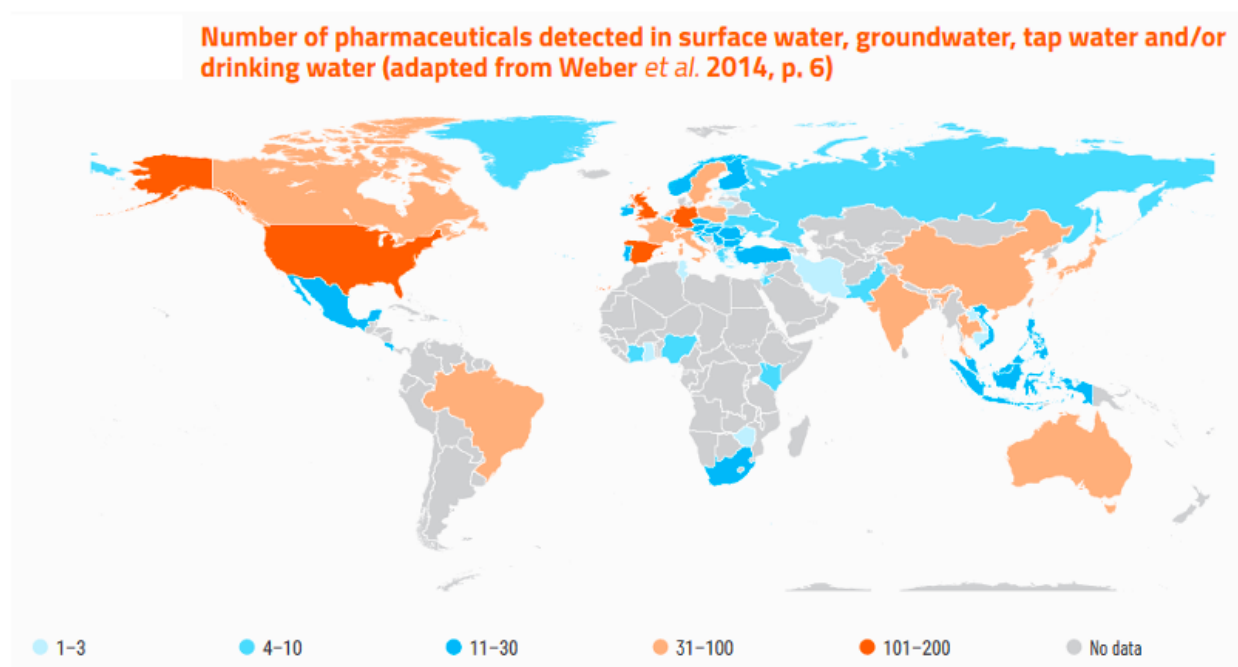


OECD (2019), *Pharmaceutical Residues in Freshwater: Hazards and Policy Responses*, OECD Studies on Water, OECD Publishing, Paris

Impact on Humans and Animals

Vulnerable communities living near wastewater treatment plants and industrial facilities are negatively affected by the practice. Synthetic chemicals used in everyday things like pharmaceuticals and cleaners are created and consumed in large quantities around the world. Most wastewater treatment plants are unable to filter these compounds out of ground and surface waters after they have been utilized. This allows them to easily enter bodies of water all over the planet, causing harm to the living species that rely on them. Not only do they travel to bodies of water around the world they also end up in tap waters that humans all around the world drink from. So naturally, these chemicals end up in the human body, and there is a growing concern that chronic exposure to

these chemicals could result in serious health issues. An example is endocrine disruptors, which come from agricultural, industrial, and domestic sources, they disrupt biological processes like growth, development, and reproduction. Another example of pharmaceuticals harming the human body is when they mix and hinder the formation of embryonic kidney cells, as identified by Italian researchers in 2006. It has an impact on humans as well as animals. Fish are one example of an animal that is severely impacted by this problem. Estrogen and other chemicals that act like it have a feminizing effect on male fish, according to several studies. Female-to-male ratios are affected by this phenomenon. Birth control medications and postmenopausal hormone therapies contain estrogen.

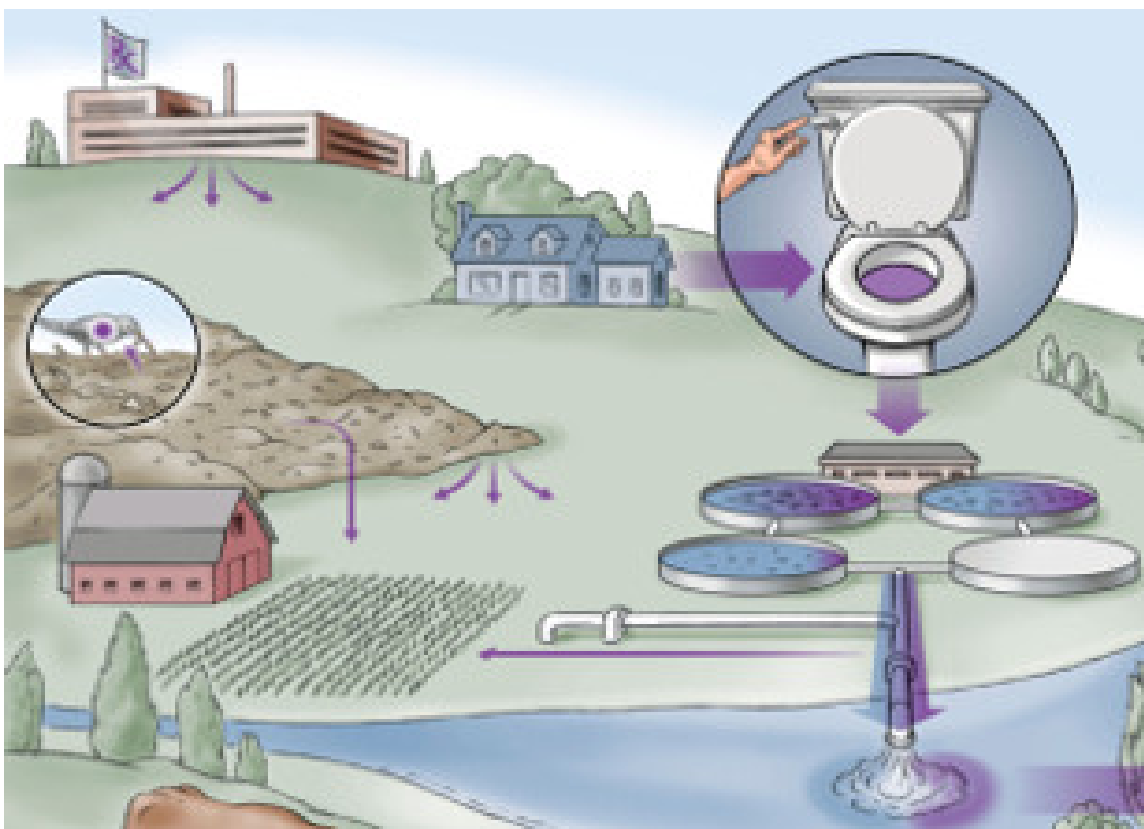


Global Chemicals Outlook II, UNEP, 2019 (p132)

Impact on the Environment

The harmful impact of pharmaceutical product manufacturing on the

environment is well-acknowledged. Pharmaceuticals do not dissolve immediately. Some last a long time in the environment and in water supplies. The chemicals begin to harm the environment once their concentration reaches a specific level, usually around one part per million. There are different types of medications, some are antiepileptics and are persistent, while others are pseudo-persistent, meaning that they degrade with time. This implies they have an impact on the environment long after they have been dumped. Some have a high-fat solubility of about 30 percent, which means they can bioaccumulate, enter cells, and travel up food chains, getting more concentrated in the process. Statistics from Europe and the US, prove that hundreds of those types of compounds have been found in groundwater, wastewater, sewage, surface water, and tap water. As a result of this, contaminated water from bodies of water eventually finds its way into human bodies.



Kim Robinson, Environmental Impact of Pharmaceuticals, Zero Waste Family, Feb 16, 2016

Major Parties Involved and Their Views

Democratic Republic of Congo

Forming part of sub-Saharan Africa, the Democratic Republic of Congo contains river water with the highest percentage of pharmaceutical pollutants. This is due to their poor infrastructure and pharmaceutical manufacturing. This harms not only the animals in the surrounding area, but also the humans who also drink the river water. Rivers in sub-Saharan Africa are filled with Propranolol which is a beta-blocker for heart problems like blood pressure and Sulfamethoxazole which is an antibiotic for bacterial infection.

Germany

Germany is the second country in the world that exports the highest dollar value worth of drugs and medicines. They were 14.9% of the total export worldwide of drugs and medicine, Making over \$60.8 billion dollars

Poland

Poland is the first country in the world that exported the highest dollar value worth of drugs and medicines. They exported over 34.9% of the entire drugs and medicines in the market. Poland made over \$95.8 billion dollars in the drug industry.

Indonesia

Located in Southern Asia, Indonesia forms part of the countries with the highest EPPP(Environmental Persistent Pharmaceutical Pollutants) contamination in their

rivers. Filled with Ciprofloxacin which is an antibiotic for bacterial infection and Loratadine which is an antihistamine for allergies they cannot provide clean water for their residents and the animals in their surroundings. Furthermore, Indonesia has one of the fastest-growing pharmaceutical markets in the world which causes direct pharmaceutical pollution into the environment.

United States

United States is the country with the largest pharmaceutical industry in the world. In 2018, they generated over \$484.8 billion dollars in medicine which were over 40.4% of the \$1.2 trillion dollars in medicines produced worldwide. Furthermore, the United States is one of the countries with the highest human domestic drug use behavior. As consumers, we are one of the highest producers of EPPs due to the way we dispose of old medicines and personal care products.

Timeline of Events

| Date | Description of event |
|---------------|---|
| 1885 | The first-ever pharmaceutical company was founded in Germany |
| Last 50 years | Researchers have found that over half of the planet's wild animals have been wiped out |
| Early 1990s | Pharmaceutical were found in the environment which resulted in massive scientific research |
| 2011 | First legislation to keep drugs out of the water was implemented. In the U.S.A. |
| 2014 | the European Federation of Pharmaceutical Industries and Associations (EFPIA) began creating legislation with the help of |

2019 Germany and Sweden to prevent further spread through the rivers. Over 5 million people died due to bacterial infections because of their resistance to antibiotics. These regions suffered from high drug pollution in their waters which is one of the causes for the antibiotic resistance

2022 Scientists found APIs (active pharmaceutical ingredients) in over 104 countries on every continent.

UN involvement, Relevant Resolutions, Treaties, and Events

The UNEP recognizes the many consequences of Environmental persistent pharmaceutical pollutants and their seriousness.

- PPPs (environmental persistent pharmaceutical products) were named an emerging policy issue at the International Conference on Chemicals Management (ICCM 4) in 2015.
- Stakeholders pledged to cooperate with each other to raise awareness and understanding among policymakers and stakeholders, as well as to exchange and develop data to close knowledge gaps (ICCM 4 Resolution IV/2 part III).
 - This resolution urges for coordinated efforts among Inter-Organization Program for the Sound Management of Chemicals (IOMC) organizations to offer consistent and evidence-based guidance to governments.
- The UNEP is one of the Important IOMC collaborating agencies, which is working on the issue. As this is a recent issue and has not been in mind for a long time, many agencies still do not have much information and data on the topic. This then doesn't allow them to see how serious the issue is. In response to this, the UNEP is developing a scoping and mapping exercise

to collect and gather data on environmentally persistent pharmaceutical pollutants at various stages of their life cycle. This includes their presence in wastewater, existing studies and practices, applicable legislation, stakeholders involved, and ongoing work.

- Based on all these findings the UNEP is focusing work and research on take-back programs and ecologically sound disposal of unwanted pharmaceuticals as well as antimicrobial resistance, and sustainable procurement concerns based on these results.

Past Action

Over 30 pharmaceutical companies have noticed the detrimental effects their industry has on the environment. Therefore, several countries and governments have put pressure and legislation on this industry to prevent this issue from continuing and spreading further. However, this issue does not seem to have an end or solutions in the near future.

The continent of Europe has shown the most initiative to solve this issue. To begin with, the European Legislation introduced tighter regulations on Europe and a national level as well. The most concerned countries are Germany and the Scandinavian states. Both countries are severely active in lobbying other countries to imply new regulations. The Swedish government proposed the EU should extend its scope of GMPs (good manufacturing practice) to cover environmental effects on the production of pharmaceuticals.

A couple of years later the EU preamble legislation stated, "the contamination of water and soil with pharmaceutical residues is an emerging environmental concern." Which led them to the implementation of new rules in September 2017. For example; the European Medicines Agency (EMA) set an environmental database on substances to have a non-toxic environment proximately.

Possible Solutions

Due to the fact this is such a complex and recent problem, there haven't been many answers proposed; nonetheless, there are some potential solutions that could be discovered through brainstorming. Possible solutions include proper drug disposal, stricter restrictions, and reducing bulk purchasing, all of which would help reduce the environmental harm caused by persistent pharmaceutical pollutants.

The simplest and most cost-effective answer to this issue is to keep medications out of bodies of water and streams. Large sums of money should be spent on public education about proper drug disposal. Humans will be able to properly dispose of old/expired medicine, which contributes to pharmaceutical pollution, thanks to these investments.

Reduced bulk purchase is another viable answer. Because big volumes offer discounts, most institutions, and individuals buy medications in bulk. As a result, the entire pricing becomes more appealing, resulting in more purchases. This, on the other hand, leads to the problem of unneeded medicines being flushed or disposed of incorrectly. Limiting bulk purchasing ensures that only the amount required is delivered, resulting in less pharmaceutical pollution.

Finally, indicating harsher regulations is another possibility. If stronger laws are enacted, the amount of medicine flushed in hospitals, nursing homes, and other healthcare facilities will be reduced. These laws can be implemented by a country's national health agency. The institutions would be prohibited from disposing of the pharmaceuticals without following proper procedures, and they could also ensure that their relationships with drug manufacturers are such that the drugs can be returned once they have expired.

Sustainable Development Goal (SDG)

The global issue of persistent pharmaceutical environmental pollutants tightly correlates with the sustainable development goal of responsible consumption and production. This is due to the high negligence of pharmaceutical companies which do not take into consideration the environment when disposing of their unused or outdated medicines. Furthermore, humans who dispose of them in toilets end up in the world's sewage.

The UN Climate action SDG consists of taking urgent action to combat climate change and its impacts. When discussing the Measures to address the effects of environmental persistent Pharmaceutical pollutants, the discussion revolves around the measures needed to have clean water free of contamination and pollution for all. One of the highest areas for SDG 13 is in fact freshwater resources, this then connects back to the topic of discussion in issue bulletin 1, UNEP. Although pharmaceuticals are essential in the development of the medical research field it does not mean that the impact they have on the environment should be overlooked. As stated above after pharmaceuticals are disposed of they easily end up in rivers, aquifers, and lakes. This transmission then easily accesses the lives of billions of living organisms, as the water bodies in which the waste is dumped in the most accessible body of water for organisms to then hydrate. This cycle continues on and on, animals, humans, and other organisms then ingest contaminated water that came from this waste. SDG 13 clearly states the importance of freshwater resources, once again since water is the basic necessity for all living creatures. Not only does it connect to the importance of freshwater resources but it also links to human health, which is also a high priority area for SDG 13, climate action. Now, this could be a contradictory statement as pharmaceuticals are meant to help people, nonetheless having such pharmaceutical waste in one's water resource could

cause more harm than good as it is contaminating the resource with unnecessary waste. Furthermore, it also goes on to develop a connection between terrestrial and wetland ecosystems, which as mentioned previously, affects all living organisms in such habitats that are affected by the waste dump of pharmaceuticals. Consequently, as medical researchers go on to develop new pharmaceuticals they must also weigh the impact it has on the environment. That being said, this is SDG 13, climate action, crisis.

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Appendix

Useful links for research:

I. Links

- A. <https://saicmknowledge.org/library/saicm-environmentally-persistent-pharmaceuticals-pollutants-video>
 - This link helps the researcher understand what exactly environmentally persistent pharmaceutical pollutant are.
- B. https://en.wikipedia.org/wiki/List_of_countries_by_pharmaceutical_exports
 - This link helps to show which countries benefit the most from pharmaceuticals.
- C. <https://www.openaccessgovernment.org/rivers-pharmaceutical-pollution/129831/>
 - This link helps understand the importance of the issue and its severity.
- D. <https://www.pnas.org/doi/10.1073/pnas.2113947119>
 - This link helps to understand how severe the problem is, and to what extent is it globally affecting countries rivers. This link also talks about the socioeconomics of pharmaceutical pollution
- E. <https://eeb.org/the-problem-of-pharmaceutical-pollution/>
 - This link helps identify the problem and what it is.
- F. <https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/environmentally-persistent-pharmaceutical>
 - This link helps to understand what exactly environmental persistent pharmaceutical pollution is, and what exactly is being done by the

United Nations Environmental Program.

- G. <https://www.conserve-energy-future.com/pharmaceutical-pollution.php>
- This link helps understand what pharmaceutical pollution is, and its causes and effects.
- H. <https://www.theguardian.com/environment/2022/feb/14/drugs-have-dangerously-polluted-the-worlds-rivers-scientists-warn>
- This link is an article where the environmental writer Damian Carrington states how and why drugs have dangerously polluted the world's rivers.
- I. <https://www.circleofblue.org/2011/world/unprescribed-u-s-pharmaceutical-industry-fights-to-avoid-paying-for-drug-disposal-programs/>
- This link is an article about a legislation to keep drugs out of bodies of water in the United States of America.
- J. <https://www.theguardian.com/environment/2014/oct/13/drugs-flushed-in-to-the-environment-could-be-cause-of-wildlife-decline>
- This link is an article where the environmental writer Damian Carrington connects the Pharmaceutical Pollution to wildlife decline.