Could Your Bathwater contain Drugs?

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Introduction

According to the Centers for Disease Control, the most recent statistics from the United Nations International Children's Emergency Fund state that there were more than 785 million people that did not have accessible water, while 884 million did not have safe drinking water (UNICEF, 2017). Our treatment of water quality has been downgraded as our knowledge an innovations across multiple other areas of life have skyrocketed over time. While large, physical pollutants and common sludge can be easily removed from water to mark it as "safe," other substances have been found to remain in the water supply of the 71% of global citizens who have access to "safe" water. The definition of "safe" has been characterized by public policy and are allegedly influenced by scientific research. These policies are then used as the starting point for standards set by public and private water treatment plants that serve the general public in all countries. Ultimately, these policy standards are the defining terms that dictate what gets to be in the water we use every day—for most, even the one substance most interacted with on a daily basis. In the past, the current standing policies seemed to be safe enough, but recent researchers in the public health sector and environmental control

industries alike have been advocating to spread awareness for a lesser known but just as harmful pollutant class in our drinking water: pharmaceuticals.

Where does it come from?

Pharmaceutical pollutants come from multiple sources. The majority of these pollutants are sourced from places that are directly interacting with pharmaceutical production such as factories, or clinical usage such as hospitals, but some lesser-known sources come from our daily usage of over-the-counter substances, prescription

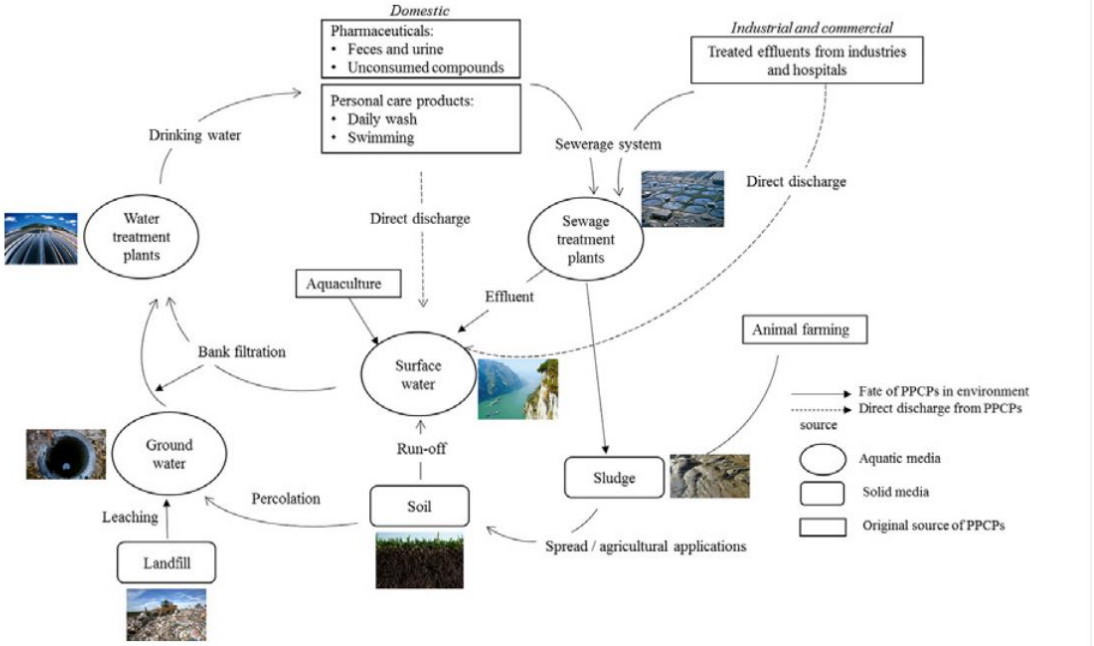

Figure 1. Semi-cyclic Flow of PPCPs into waterways. Figure sourced from Yang (2017). Symbol legend for reference provided in the bottom right. Flowchart's intended purpose is to demonstrate the semi-cyclic nature of the transport of pharmaceuticals throughout the commonly used water supply.

medication, and even commonly abused substances. When we excrete these substances in waste, they enter the water that washes everything away into the pipe system, out of sight and out of mind (Yang 2017).

The problem arises here as this is where the source of the problem exists. See, the source of pollution is relatively unavoidable with our current reliance on pharmaceuticals to support our current public health industry. The solution, then, pushes on to the next possible cause, improper water filtration. Our water treatment systems are equipped to deal with large, solid pollutants and other dissolved contaminants. What they have proven to be particularly insufficient for is the removal of chemically bonded contaminants (Adams, 2002; Vona 2015). Often enough, this is because of the way pharmaceutical substances tend to work with water. The chemistry between the two substances makes it so that chemical processes are needed to remove certain pharmaceutical substances from the wastewater treated at the plants (Carballa, 2004; Batt 2006). When this doesn't happen, the water is processed straight through the plant and released, either into the environment or right back into our water supply for us to reuse and consume once again.

Why should we care?

Although we are only exposed to small amounts of substances at a time via this method, it is still worth being

concerned over the consequences of micro exposure. Effects that directly concern human exposure involve unmeasured and unintended dosages. We know that the chronic consumptions of NSAIDs results in stomach ulcers and other gastrointestinal issues. Because of additional exposure that potentially occurs daily from the city water supply, it is in fact possible to develop these chronic ulcers overtime without overuse of NSAIDs. This is just one example of how trace exposure via water can disrupt the intention to moderate use of specific medications. In addition, it is also possible to become exposed to certain addictive recreational substances. In Dutch waterways, it was found that the average dosage a person could be receiving from their water of certain recreational drugs was as high as 100 grams a day for certain substances (Bijlsma 2017). One of the most commonly consumed medications is also hormonal birth control. Synthetic hormones that regulate ovulatory cycles are also secreted from the body and into the water. Due to documented similarities in the way that hormone pathways work in both fish species and humans, research done on fish show that there are significant reproductive changes ranging from issues with fertility to entire changes in gender. With reasonable suspicion, it's understandable to be concerned that these changes can also be presented in humans. Speaking of fish, insufficiently treated water can be released back into waterways where the fishing industry farms or agricultural industry yields crops, causing toxin buildup and pollutants to enter our bodies through our food supply.

What can we do?

With the plethora of concerns apparent, it can be overwhelming to think that it's unavoidable to stop drinking water, and far too paranoid to test all water ourselves. Although the bigger issues require action that may seem far above the station of the neighborhood citizen, there are measures that can be taken at the household level to mitigate exposure. Most households should have at least one water source that involves a carbon filter. Although these filters are efficient at the household level, they are not viewed as cost-effective for water treatment plants. They are proven to be effective at reducing the amount of pharmaceutical pollutants within water (Vona, 2015). Additionally, to affect policy there are lobbying activities and other means of spreading political awareness to these concerns. Scientists have been researching this topic substantially, and there is hope that the legislators responsible for regulating the companies that ensure we are consuming safe water.

Sources

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