

## METFORMIN: Are there impacts to my health and the environment?

People with Type 2 (adult onset) diabetes have a higher risk of getting some kinds of cancer: it is 2 times higher for cancers of the liver, pancreas and endometrium, and 1.2 to 1.5 times higher for colorectal, kidney, bladder and breast cancers.<sup>1</sup> Men with Type 2 diabetes have a lower risk of getting prostate cancer, but for those who do develop this type of cancer, their risk of dying from it is higher.<sup>2</sup>



Metformin is one of the most frequently prescribed medications for treating Type 2 diabetes. It was approved for use in Canada in 1972, and in the US in 1994.<sup>3</sup> Because it has been so widely used for many years, there are a lot of data available to study the long-term effects of taking metformin. Very few harmful side effects from taking metformin have been found to date. Most commonly, people may experience stomach upset, but this decreases over time.<sup>4</sup> There is some debate about women taking it during pregnancy.<sup>5</sup>

Diabetic people who take metformin have fewer cancers than expected, suggesting that metformin may actually help to prevent cancer growth. This has been reported for liver, pancreatic, colorectal and breast cancers.<sup>6</sup> The evidence is strong enough that medical researchers are now studying how metformin affects cancers, and whether it can be used as a cancer medicine.<sup>8,9</sup>

Metformin is not broken down in the body and is excreted in urine and feces. Sewage treatment can reduce metformin levels considerably, but it is still detected in waste treatment discharges and surface waters around the world.<sup>10</sup>

The [First Nations Food, Nutrition and the Environment Study](#) recently measured pharmaceuticals in surface waters in Ontario. Metformin was detected in waters near 7 out of 17 communities in the study. The maximum measured level was 5.6 µg/L. In comparison, the maximum level measured within 200m downstream of sewage treatment plants in Nova Scotia was 10.6 µg/L.<sup>11</sup> The average measured level in Jamaica Bay, New York, which receives 261 million gallons of treated waste water and storm water runoff daily, was 11 µg/L.<sup>12</sup>

To put these levels into context, we found two recent health risk assessments, both prepared by pharmaceutical companies and consultants and published in peer-reviewed journals. These assessments report an Acceptable Daily Intake (ADI) for metformin in drinking water of 62 µg per kg of bodyweight per day for children<sup>13</sup> and 79.4 µg per kg of bodyweight per day for adults.<sup>14</sup> This means that a child

weighing 25 kg (55 lbs) can drink up to 155 litres per day of contaminated water containing 10 µg/L of metformin with no negative effect. An adult weighing 75 kg (165 lbs) could drink almost 600 litres of water per day with 10 µg/L of metformin with no negative effect. In both studies, 'negative effect' was defined as "any effect, including the pharmacologic effect or even a benign or beneficial effect."<sup>15</sup> In other words, the risk of experiencing any effects through exposure to metformin in contaminated drinking water is extremely low.

Researchers are also beginning to study the effects of metformin in water on fish. At a concentration of 40 µg/L, adult male fathead minnows showed indications of endocrine disruption after 4 weeks.<sup>16</sup> A second study by the same group looked at fathead minnows reaching maturity and living for 360 days in water containing 40 µg/L metformin. Female minnows had significantly smaller clutches of eggs. Males had significantly increased incidence of intersexuality, a condition linked to endocrine disruption.<sup>17</sup>

**In conclusion, the use of metformin as an anti-diabetic medication is not associated with increased cancer, but may actually decrease the risk for certain cancers. It is very unlikely to pose a danger to people exposed through contaminated drinking water. Metformin in freshwater may disrupt the reproductive capabilities of fish living and breeding near sewage treatment outfalls, which may have unknown ecosystem effects.**

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<sup>2</sup> Morales, Daniel R., and Andrew D. Morris. "Metformin in cancer treatment and prevention." *Annual review of medicine* 66 (2015): 17-29.

<sup>3</sup> [https://en.wikipedia.org/wiki/Metformin#cite\\_note-Bailey-12](https://en.wikipedia.org/wiki/Metformin#cite_note-Bailey-12)

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