

- Drinking water

## Should people worry about nanoplastics?

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What does it mean that scientists found 240,000 nanoparticles of plastic in a typical bottle of water? The number is big and sounds alarming, but it is not very informative. How many particles are needed to cause disease? What kinds of ailments are likely to result? Are there people who are dead now who would be alive if they had avoided bottled water?

These questions need to be addressed to before we can make informed decisions at the individual and societal level. Should we ban plastic bottles for water and other drinks? Require health warnings? Would doing so save lives — or would it only take attention and money from more pressing health problems?

Nanoplastics are smaller than a wavelength of light — too small to see with an optical microscope. Previous studies showed they were there, including one published in *Scientific Reports* in 2021, demonstrating how to detect them in bottled water.

To detect these nanoparticles, scientists can take advantage of a phenomenon called Rayleigh scattering. Shine a laser through pure water and you will not see the beam. Add enough tiny particles, even nanoparticles, and the beam becomes visible. This also works in air — add nanoparticles in the form of smoke and scattering makes the beam visible. More particles mean brighter scattering.

The new study, published this week in the *Proceedings of the National Academy of Sciences*, used a different laser technique. It revealed more particles per bottle than the 2021 study, though it was not clear why the two methods got such different results.

What consumers need to know is how much plastic is in a glass of tap water versus bottled water, and whether reusable bottles — which are often made of harder plastics — face the same problems as cheaper plastic bottles. Do home filtering systems add or remove plastic nanoparticles?

Questions about the health impacts of nanoparticles getting into the body are hardly new, retired industrial chemist Mark Jones said. Health implications of inhaled and ingested nanoparticles from gas stoves, wood fires, candles, cigarettes, e-cigarettes, diesel engines and more are well studied. We are all exposed, in many cases to far more nanoparticles than are present in bottled water. Airborne nanoparticle concentration is most commonly reported in weight per volume of air and exposure tracked by mass. However, is it the total amount of plastic or the number of pieces that matter most?

We do not ingest quite as much plastic as the media have widely reported. In the past several years news organizations have been repeating we eat about a credit card's equivalent in plastic every week. That figure, 5g, is dubious. Other scientists have found major errors in that analysis and subsequent studies give estimates a million times lower.

And most of the plastic we consume comes from the larger particles. The smaller nanoparticles, identified in the new study, do not make a significant change in the total mass ingested. Even 240,000 nanoparticles weigh only trillions of a gram. The study suggests,

however, that it is their small size that might pose the danger. Nanoparticles can slip into the bloodstream, get into organs and sneak into cells where they might cause harm. A paper published in *The Lancet* last month goes through models and animal studies showing that plastic likely goes into most of our major organs and even affect the good bacteria that makes up our microbiome. That is not proof of harm, just reason for concern. It also points to more research being needed.

It is hard to do direct human studies on long-term effects, but a small study showed there was more plastic in people with liver disease than those with healthy livers, and another small study found plastic particles in human blood clots. Animal studies suggest that plastic particles can cause male infertility and can cross into a fetus during pregnancy. Some studies suggest that not all plastic particles are equally dangerous. Some studies showed noticeable health effects only from plastics with certain additives not found in water bottles.

The plastic problem can seem overwhelming when particles get inside our bodies from the air we breathe, the food we eat and the beverages we drink. It is not just bottled water but likely all those popular sodas, juices, sports drinks and other beverages sold in plastic bottles. Many reusable bottles are plastic or have plastic lids. Tackling the problem requires more information about sizes and kinds of particles that are most dangerous and where they come from.

Cutting back on water is not the answer — hydration is vital for health. Not to mention that exercise is good for us, and it is much easier and more fun to be active when you are not dehydrated.

So perhaps as a first step we could demand more drinking fountains, more water coolers and studies that vouch for the safety of reusable bottles. Maybe there is a technology fix, something that can be done to reduce the production of the particles. There could be demand for new forms of packaging. There could be a new demand for water and other drinks sold in glass bottles.

However, enough alarming data have now amassed that it is time to move from fear and outrage to action.

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