The BPA Emperor Has No Clothes

Steven Hentges, Ph.D

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Most likely you've never heard of Paracelsus, a Swiss physician from the 14th century, but you live every day with a toxicology principle that he created. That principle, simply stated as "the dose makes the poison," has stood the test of time for about 500 years.

For example, if you have a couple of drinks you might get a hangover, but if you drink too much you could die from alcohol poisoning. A couple of aspirin might help with the hangover, but a whole bottle of aspirin could act as a poison and kill you. In both cases, it's the **dose** that makes the poison, and that principle applies to just about everything we contact in our daily lives.

In simple terms, the safety of a substance is determined by first testing to establish a dose at which no health effects are observed, and, therefore, the dose is considered to be safe. Consistent with Paracelsus' principle, if exposed to an even lower dose, no health effects would be expected at those lower doses either.

In recent years though, some scientists have questioned whether Paracelsus had it right. In particular, they've suggested that very low doses of some substances could cause a health effect while the established safe dose of the same substance does not cause the health effect.

That counterintuitive relationship between dose and health effect is known scientifically as a "non-monotonic dose-response" relationship or NMDR. If NMDR is a real phenomenon, the basic paradigm for determining safe levels of exposure may not be valid for all substances.

A common example of a substance considered by some scientists to exhibit NMDR is BPA. For example, a recent scientific paper referred to "a wealth of prior literature showing that BPA … can have non-monotonic dose response curves."

Although it has been frequently stated that BPA and other substances have NMDR, simply saying it is so doesn't make it so. In science, solid evidence is required to support the validity of a supposition, in particular one as far-reaching as the claims about NMDR.

As indicated by the title of a recent publication in the peer-reviewed scientific literature (*Evaluating the evidence for non-monotonic dose-response relationships*), the validity of NMDR has now been tested with scientific evidence. Notably the analysis was commissioned by the European Food Safety Authority (EFSA) and conducted by a panel of scientists from four European government agencies and scientific institutes.

The EFSA expert panel first scoured the scientific literature for studies that might include evidence for NMDR on substances relevant for food safety, which includes BPA. Studies deemed to be relevant and reliable were then evaluated against six checkpoints specifically designed to assess the strength of the evidence for NMDR.

The results of the expert panel evaluation are distinctly at odds with common wisdom about the validity of NMDR:

NMDR as a common phenomenon for substances in the area of food safety was not substantiated by the data selected and analyzed in this review.

Overall, the results of this review show that the empirical evidence for NMDR in the scientific literature for substances in the area of food safety is limited or weak.

Of the studies considered to be relevant and reliable and that met the checkpoints for NMDR, how many provided evidence that BPA displays the so-called NMDR phenomenon? There were none – no sound and reliable scientific evidence at all to support claims that BPA exhibits NMDR.

The findings of the expert panel have important implications for the safety of BPA. Based on scientific evidence, and consistent with Paracelsus' principle, many government agencies around the world have concluded that BPA is not a health concern.

As an example, EFSA stated “BPA poses no health risk to consumers of any age group (including unborn children, infants and adolescents) at current exposure levels.” Considering the findings of the expert panel on NMDR, that conclusion continues to be valid.