

exponentially, as they have since the 1970s, by 2045 one in two US children will be on the autism spectrum.<sup>10</sup>

Plastic chemicals contribute to obesity and type 2 diabetes:

- Animal experiments exposing fetuses in the womb to EDC chemicals common in plastic cause morbid obesity in adulthood.<sup>11</sup>
- Elegant cell and animal experiments show that very low doses of BPA induce insulin resistance and type 2 diabetes.<sup>2,12</sup>
- These studies are consistent with multiple human epidemiological findings.<sup>2</sup>

Plastic chemicals may be driving the increases in obstructed bladder syndrome (OBS), where men have difficulty urinating. Think about your experience in a public restroom. How often do guys have problems urinating? In the developed world, OBS can be managed pharmaceutically and sometimes via surgery. In the developing world without advanced health care, OBS is a death sentence because it leads to kidney failure. For people in the US without sufficient health insurance to cover the intensive treatments required, OBS is also a death sentence.

- The only animal model that manifests obstructed bladder syndrome is caused by BPA exposure in the womb, coupled with natural hormonal changes that occur as men age. It can also be induced by an adult exposure to BPA when fetal exposure had preceded adult exposure. This “second-hit” pattern is common in EDC studies. Fetal exposure sets it up. A second exposure later in life seals the deal.<sup>13</sup>
- A 6-year prospective epidemiological study found that BPA is a predictor of chronic kidney disease and high blood pressure in men.<sup>14</sup>

Plastic-related EDCs are strongly implicated in causation of cardiovascular disease, the leading cause of death for men and women and people in most racial and ethnic groups in the US.<sup>15</sup> A now famous prospective study reported that levels of BPA measured in adult men was a strong predictor of heart disease victims a decade later.<sup>16</sup> Phthalates are also associated with cardiovascular diseases.<sup>17</sup>

Perhaps the biggest surprise in EDC research over the past 30 years has been the discovery and repeated reporting of “transgenerational epigenetic inheritance,” including with plastic-related chemicals such as organotins, bisphenols and plastics. Fetal exposure during crucial windows of development cause effects not only after birth, but those same (and related) effects are carried on to subsequent generations, with no changes in DNA sequence. What changes are the control mechanisms (epigenetic) for how hormones

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<sup>10</sup> p97-98 in Demeneix, B. Toxic cocktail: How chemical pollution is poisoning our brains. Oxford University Press 2017.

<sup>11</sup> Obesity II: Establishing causal links between chemical exposures and obesity. doi: 10.1016/j.bcp.2022.115015

<sup>12</sup> Endocrine disruptors in the etiology of type 2 diabetes mellitus. doi:10.1038/nrendo.2011.56

<sup>13</sup> Interactive effects of perinatal BPA or DES and adult testosterone and estradiol exposure on adult urethral obstruction and bladder, kidney and prostate pathology in male mice. doi: [10.3390/ijms21113902](https://doi.org/10.3390/ijms21113902)

<sup>14</sup> Serum bisphenol A as a predictor of chronic kidney disease progression in primary hypertension: a 6-year prospective study. DOI:10.1097/HJH.0000000000000780

<sup>15</sup> Heart disease facts. US Centers for Disease Control and prevention. <https://www.cdc.gov/heartdisease/facts.htm>

<sup>16</sup> Urinary bisphenol A concentration and risk of future coronary artery disease in apparently health men and women. DOI: 10.1161/CIRCULATIONAHA.111.069153

<sup>17</sup> Phthalates implications in the cardiovascular system. <https://doi.org/10.3390/jcdd7030026>