

There's good reason to worry about the health risks of plastics

Some findings suggest tiny plastic particles could disrupt immune and endocrine systems, damage organs, and cause other health problems

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April 2, 2022 at 9:00 a.m. EDT

An emerging domain of research shows that plastic consumption and pollution harms human health — particularly for the world's lower-income communities.

This builds on a growing field of research revealing the dangers of plastic on the environment — especially marine ecosystems. Of the over 8 billion tons of plastic produced since the 1950s, less than 10 percent has been recycled.

“Plastic threatens human health at every stage of its production pipeline — from the extraction of the fossil carbon, oil and gas, that is plastic's main constituent, to its manufacture, use and disposal,” said Philip Landrigan, director of the Global Observatory on Pollution and Health and lead author of the Lancet Commission on pollution and health.

The connection between plastics and health was also highlighted in Africa by researchers from Stanford and the Technical University of Mombasa. After decades of hunting for mosquito-borne viruses in coastal Kenya, they received one of their greatest tips from a group of elementary schoolchildren.

The scientists had been trying to uncover the breeding grounds of mosquitoes causing a number of illnesses that regularly sicken over half of Kenya's coastal population — including dengue, chikungunya and others that can cause severe fevers, headaches, rashes, joint pain, life-threatening bleeding and death.

With these diseases on the rise, researchers were teaching schoolchildren about the life stages and habitats of insects that serve as vectors. On a homework assignment to find immature forms of mosquitoes in their communities, the children discovered something unexpected — disease-carrying mosquitoes breeding in nests of plastic trash around their homes.

“We were astounded,” said Stanford pediatrician and researcher Desiree LaBeaud, who led the project. “The children's discovery helped us realize that the majority of mosquitoes were breeding in plastic trash and other containers littering streets and people's yards.”

Environment and health

It made sense: Plastic is watertight and can take hundreds of years to break down, creating a perfect habitat for mosquitoes. This groundbreaking discovery built on other recent findings connecting environmental degradation to human health — including the health effects of wildfire smoke, heat stress and the risk of pandemics caused by deforestation and other ecological disruptions. With climate change driving an increase in mosquito-borne illnesses, the need to limit their breeding grounds felt more important than ever to the researchers.

“We realized that we needed to look far beyond just treating the sick,” said LaBeaud, who is senior author on an upcoming publication in PLOS Neglected Tropical Diseases on the topic. “To stop these diseases at their source, we needed to tackle the plastic problem.”

Plastics are closely tied to climate change, which the National Academy of Medicine (NAM) has recognized as “one of the most pressing existential threats to human health,” in the words of NAM President Victor J. Dzau. Plastics use the same amount of oil as the entire aviation industry — and are expected to more than triple in their oil consumption in the next 30 years.

Moreover, the pollution caused by petrochemical plants — which are most often in lower-income settings — threaten the health of communities. “Plastic manufacture is inequitably distributed, with virtually all plastic production facilities located either in low- and mid-income countries or in poor and minority communities within high-income countries,” Landrigan pointed out.

After plastic products are released into the environment, they can break down into smaller pieces of plastic known as microplastics. While more research is needed, some findings suggest these virtually ubiquitous tiny plastic particles — that have been found in human blood — have the potential to disrupt immune and endocrine systems, damage organs, cause inflammation, increase cancer risk and possibly affect pregnancy outcomes.

Disposing of plastic waste also poses challenges. In places such as sub-Saharan Africa, as much as three quarters of all waste is burned, releasing toxic compounds and carcinogens into the air.

The infectious-disease research in coastal Kenya is a critical new dimension. Plastic pollution is exacerbating an already dire public health challenge — over 50 percent of people in coastal Kenya are regularly exposed to dengue and chikungunya, and at least 10 percent of febrile illness in the region is probably because of undiagnosed mosquito-borne viral infections. This pattern seems to be widespread — similar findings have emerged in South America and Asia.

The problem is not only the potentially deadly diseases themselves. With symptoms for some illnesses such as chikungunya lasting for up to months or years, getting sick could also mean missing school and days of work — and communities being kept in poverty, creating what some scholars call the “disease-poverty trap.”

“The case of plastics vividly illustrates how the industrial practices of the high-income world are intimately tied to the health and development of lower-income communities around the globe,” LaBeaud said. “Maintaining a healthy planet requires thinking carefully about how we produce, consume, and waste — knowing that downstream health impacts, especially on marginalized communities, won't always be immediately apparent.”

Fighting a growing problem

Combating the plastic pollution in Kenya and other African countries involves addressing both exported recycling from high-income countries and an influx of new plastic products, especially single-use materials.

Kenya, along with 95 other countries, received more than 1 billion pounds of foreign plastic waste from U.S. exporters in 2019 alone. This roughly equates to a line of 18-wheeler semi-trucks full of plastic trash backed up for about 350 miles, stretching nearly the entire length of Florida. And it's not just plastic trash imports — Nairobi also saw a [quadrupling](#) in plastic consumption over the same 25-year period that its population only tripled.

In response, Kenya banned single-use plastic bags in 2017 and banned all single-use plastic in protected natural sites in 2020. This is part of a larger movement to reduce plastic waste in Africa. The African Union, for example, has set a goal that 50 percent of waste used in African cities be recycled by 2023.

[Communities across Africa](#) have also started exploding with locally designed solutions — exploring opportunities to rethink waste management and recycling in ways that also support local economies.

For example, LaBeaud and Kenyan partners launched a nonprofit organization, [HERI-Kenya](#), to engage policymakers, communicate the plastic-disease connection, and build business opportunities that allow for more locals to make a living collecting and recycling trash. This, they hope, can build the foundation for what is known as a circular economy for plastics, where the reuse and recycling of materials create a sustainable system of zero waste.

“When we remove plastic litter, we not only improve local environments — we improve human health, beautify our community, support local entrepreneurs and boost tourism,” said Francis Mutuku, a researcher at the Technical University of Mombasa and LaBeaud’s long-term collaborator. “Everyone stands to gain.”

Yet, despite the will to act, activists and lawmakers in Africa have found that the solution is not as simple as recycling or banning plastics.

With fossil fuels increasingly falling out of favor, actors such as the American Chemistry Council (ACC) and large oil companies are reportedly moving toward a new strategy, opting to turn oil [into plastics](#) and distribute them to external markets, including countries in Africa. While the ACC has [denied](#) efforts to undermine bans on single-use plastics in places such as Kenya, many of the companies it represents are still expanding their production and distribution of plastics.

Oil and chemical companies were reportedly planning to spend an estimated \$400 billion on [expanding plastics production](#) as the biggest anticipated driver of oil demand — up to 95 percent by some forecasts — from 2020 to 2024, according to a 2020 Carbon Tracker analysis. From reporting around that same time, almost 350 [new chemical plants](#) were being planned in the United States alone.

In 2019, Chevron Phillips Chemical, a joint venture partially owned by Chevron, called [petrochemical collaborations with Qatar Petroleum](#), now called QatarEnergy, “some of the safest and most successful assets in Chevron Phillips Chemical’s global portfolio” — including a new \$8 billion project to develop a Gulf Coast petrochemical plant.

“From delivering fresh water and preventing food waste to supplying medical products used every day in hospitals worldwide, our materials help people live prosperous and healthy lives,” Chevron Phillips Chemical said in an emailed statement.

Chevron’s 2021 annual report noted that petrochemical projects on the Gulf Coast and in Qatar were ongoing. In a March presentation to investors, a Chevron executive said that demand and margins for petrochemicals are expected to continue to grow over the long term.

“With growing recognition around the negative health and environmental consequences of plastics, we do need to ask — why produce more?” Stanford Center for Innovation in Global Health Director Michele Barry said. “Where are these new chemical plants being built, and which communities are the intended recipients of these products?”

Beyond recycling

Recycling is one of the most talked-about solutions for the plastics crisis.

“ACC supports scaling up advanced recycling,” said Stewart Harris, senior director of Global Plastics Policy at the ACC, in an email, referring to recycling technology that breaks down used plastics into their basic building blocks to create new, often reusable, products. “Since 2017, 70 advanced recycling projects representing over \$7 billion in investments have been announced or are already operating.”

A wide range of companies have begun to invest in improved waste collection and recycling — for example, Chevron Phillips Chemical’s investments in [circular plastics](#) and Coca-Cola’s [PETCO](#) campaign in southern and eastern Africa.

“We encourage responsible disposal of PET packaging and recycling of the same to create a circular economy, which has an economic impact on those involved throughout the recycling value-chain,” said Scott Leith, a spokesperson for Coca-Cola, who acknowledged that the challenge of plastic waste requires multiple approaches.

While some local community organizations, such as Clean Up Kenya, have criticized Coca-Cola’s approach, advocates have noted that initiatives such as this one could allow simultaneous improvements in waste infrastructure, financial incentives for collectors and worker safety.

“Partnerships between governments and the private sector are critical to achieving universal access to waste collection, which forms the foundation of a circular economy,” said Harris, in an emailed statement. Other groups such as the [Alliance to End Plastic Waste](#) are also trying to engage a variety of companies and organizations to accelerate community-engaged solutions.

Yet researchers and policymakers have pointed out that recycling is no silver bullet, because of limitations in recycling capability and the environmental costs of producing plastics in the first place.

Moreover, according to a recent Reuters analysis, [plastic recycling itself is forestalled by ongoing production](#): “Less than 10% of plastic is recycled, partly because new plastic produced by the oil industry is so plentiful and cheap.” For context, the \$7 billion investment in recycling cited by the ACC is less than 2 percent of the \$400 billion Carbon Tracker’s 2020 analysis ascribed to [expanding upstream plastics production](#).

Kenyan activists, including Clean Up Kenya, are calling for more comprehensive upstream solutions — including [banning single-use plastic bottles](#) overall.

A 2020 report by SYSTEMIQ frames plastic collection and recycling as just one dimension of a strategy to reduce 80 percent of plastic pollution by 2040. Other critical channels of action noted in the report include reducing plastic consumption, substituting materials, redesigning products, securely disposing of the near-quarter of plastic that cannot be recycled — and, particularly relevant to Kenya’s plastic challenges, reducing “waste exports into countries with low collection and high leakage rates by 90%.”

“There is an urgent need to simultaneously rein in plastic production and use in countries at every level of income,” Landrigan said.

In line with this, the United Nations Environment Assembly agreed on March 2 to begin writing a [global treaty](#) that would restrict the expansion of plastic use. Industry members such as Coca-Cola and the ACC have signaled support for such a treaty in emailed and online statements, saying it would provide needed certainty to industries.

At the same time, some nongovernmental organizations have expressed concern about the treaty’s lack of global regulations. [The ACC’s Harris](#) has said his organization does not support overall caps on plastic production, contending that plastics play a necessary role in providing critical medical services. Health and environmental researchers, however, worry about the enabling of ongoing petrochemical expansion — and the health risks this brings.

“We can’t recycle our way out of our global plastic problem,” Barry said. “Without a fundamental reimagining of global industrial practices, we will continue to see dire impacts on the climate, the planet and our health.”

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