The Right to Clean, Healthy Living: The Correlation Between Raw Sewage Exposure and Socioeconomic Disparity

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The leading risk factor causing premature death across the world is not tobacco use, road accidents, or malnutrition--but pollution exposure. Of these deaths, over 90% occur within low and middle income areas (GBD, 2016). Historically, most of these areas do not have the same access to quality healthcare that wealthier, better developed areas do. Oftentimes, these are the areas that face increased exposure to pollution. Across the world, untreated waste streams pollute water and soil systems within underserved communities. According to United Nations Water, about 80% of global wastewater flows back into the earth's ecosystem without treatment or being repurposed. Much of the impact from this is felt within underprivileged communities who do not have access to adequate sewage infrastructure to control it. About 1.8 billion people are currently using a drinking source contaminated with faeces (UN Water, 2021), which inevitably puts them at increased risk for diseases. In many low-income cities and towns within developing countries, a large amount of untreated or poorly treated wastewater is discharged directly into the "closest surface water drain or informal drainage channel" (UN Water, 2021), contaminating that communities' water sources with their own effluent. The untreated sewage water sitting in these individuals' yards likely makes its way into groundwater sources, ponds, and other bodies of water, impacting the quality of water sources that these communities have access to and also increasing the need for more intensive water treatment processes. While it is undeniable that humans inherently deserve to not see their raw sewage on a daily basis, agricultural and biological engineers should analyze to what extent it is their responsibility to aid in the prevention and cleanup efforts of raw sewage contamination.

The Black Belt region of the United States is filled with "clayey soils" that are rich and full of nutrients, but drain poorly due to their high porosity and low permeability. This has been causing a problem for decades in Lowndes County, Alabama, where sewage infrastructure is severely lacking and many residents are too poor to afford a septic tank for their household. Environmental activist Catherine Flowers realized that raw sewage was leaking into the yards of residents' homes who did not have access to a municipal sewage system (Bowman, 2021). Additionally, it has been observed that many residents have been forced to build their own makeshift sewage drainage systems out of PVC piping in order to

divert waste streams from their yards (Silver, 2017). This is a clear issue for many reasons, but most notably it leaves the residents of Lowndes County increasingly vulnerable to infectious diseases. During a site visit, Flowers encountered a pregnant woman's mobile home whose toilet waste flowed directly into a pit next to her house. A few days later she developed a strange rash that doctors were unable to diagnose, which gave her insight into just how many diseases this wastewater contains and how easy it could be to contract one.

Lowndes County, Alabama is notably one of the poorest counties within the United States, and has not favored well throughout the Covid-19 pandemic. According to data from The New York Times Coronavirus Map and Case Count Tracker, it has consistently had one of the highest if not the highest per capita infection rate and death rate within the state--despite having a relatively low population count of about 10,000 people. It has been stated that "Lowndes County has one physician and one pharmacist" (Bowman, 2021). There are currently no hospitals within the area and most residents have to drive about an hour into the state's capital for adequate healthcare. This data is indicative that Lowndes County healthcare is severely lacking, and that residents of these communities are more susceptible to succumbing to infectious diseases. Many of the communities that do not have access to well-developed sanitation systems face similar problems pertaining to raw sewage, and like Lowndes County, also lack access to sufficient healthcare systems and health education. The right to quality healthcare is a grand issue for humankind to access and work on, but there are also many targeted practices that can be put into place that can improve the overall quality of life within underserved communities.

While developing better healthcare systems for these communities is a work in process, one should consider whether or not it is the engineer's job to recognize marginalized communities' needs and bring them to attention when pertinent. To elaborate, whose job is it to recognize these issues and bring them to light in front of the right people? In a United Nations investigation of extreme poverty within the United States, a U.N. Special Rapporteur travelled down to Lowndes County, Alabama to assess the reemergence of hookworm caused by improper sanitation practices (Silver, 2017). The infection itself could theoretically be treated, but infection potential will never diminish until the county's sewage

problem is also resolved. In order to resolve this issue, the cleanup cost must be covered by somebody--and it likely will not be the residents of Lowndes County. The average income within the county is approximately $18,000, while the average cost for a septic tank is $15,000 (Silver, 2017). This scenario echoes within other underserved communities throughout the United States and also around the world. Situations such as this one could have been prevented had proper attention and funding been provided to municipal sewage treatment facilities initially, but now the damage that has resulted also has to be resolved. One of the United Nations 2030 Agenda Sustainable Development Goals is to ensure access to water and sanitation to all. In a UN Water Press release from July 2020, it was announced that progress on this goal is "alarmingly off track," and that water and sanitation services continue to be underinvested in (Blazhevska, 2020). This makes clear that the only way to ultimately provide adequate sanitation to all is for governments to feel encouraged enough to take a multifaceted approach to improving sanitation within communities in need. Furthermore, it is obvious that area's providing less economic prosperity to a nation are overlooked in terms of funding efforts and are not wealthy enough to fix their problems on their own. The biological and agricultural engineer who possesses the knowledge to physically amend many of these issues will likely encounter the need to make an ethical decision concerning the cost-benefit analysis of improving the infrastructure of an underserved community, or perhaps of implementing a municipal sewage system to an area in need. A problem like raw sewage control will likely have to be improved through proper allocation of funds, sacrifice of economic profit, extensive research, and a community of engineers and other professionals who are willing to work for the betterment of others--and even with all of these things, will still not be completely solved.

When most of us use the restroom, we typically do not have to worry about possibly seeing our waste again once it gets flushed down the toilet. The situation in Lowndes County, Alabama has demonstrated the need to focus on developing sewage infrastructure within underserved communities, ensuring that they have access to functional municipal sewage systems. Obviously this process requires a solution that is more complicated than what has been outlined above, and distribution of funding and raising awareness of this issue can only go so far. An engineer in charge may find themselves having to

decide whether or not working on an issue such as this one is worth the amount of time and effort it will require. They may also find themselves wondering how to feasibly invest within communities of lower socioeconomic status, without their efforts being shut down or impossible. It is not reasonable to expect every engineer to devote time to joining or working with organizations that serve underprivileged communities for no or little profit. Perhaps agricultural and biological engineers can consider maintaining awareness of the types of issues that plague underprivileged communities so that they can utilize their knowledge to assist when possible.

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