CHAPTER 18

Dump and pump: The impact of COVID-19 and income on septic system pumping patterns in Athens-Clarke County, Georgia

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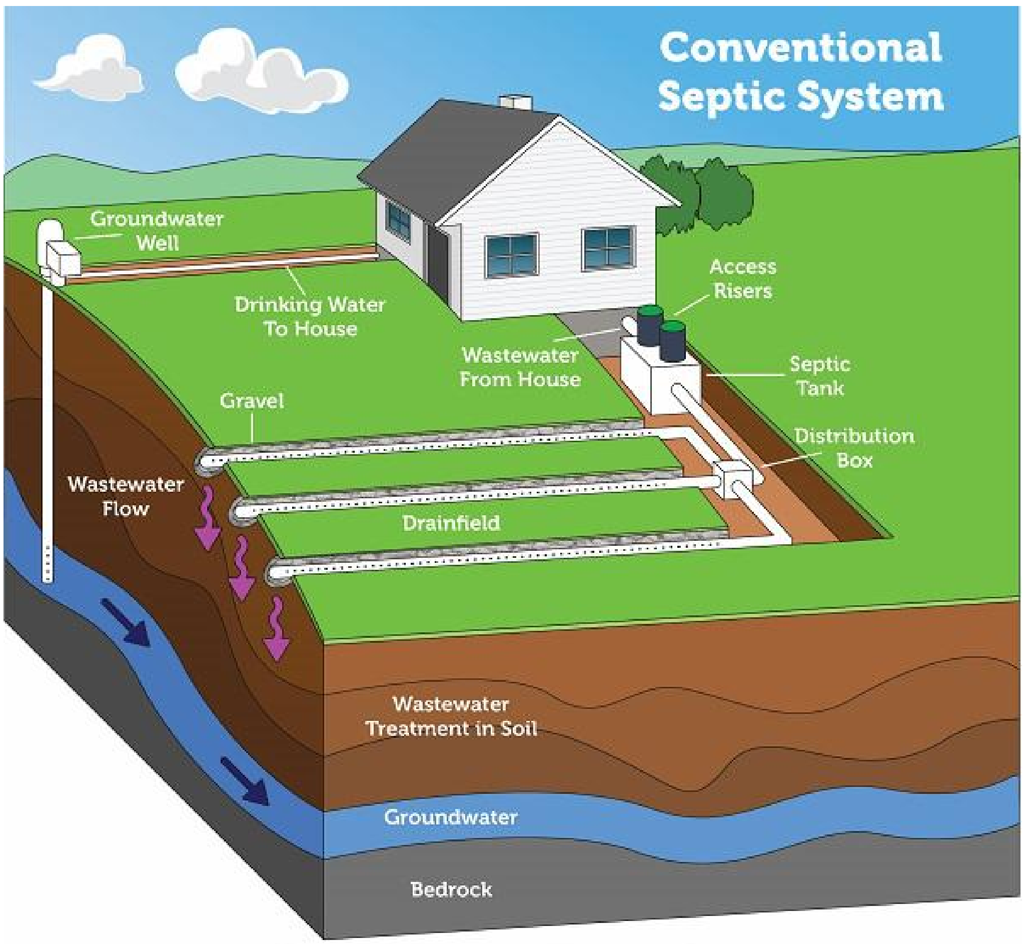

Fig 1: Diagram of conventional septic system. Not drawn to scale.

Introduction

Septic systems are widely used in wastewater treatment in the US (United States), with an estimate of ~16.4% or more than one in five households depending on septic to treat their wastewater (Hernandez & Pierce, 2023; USEPA, 2023). Septic systems are self-contained treatment systems that typically begin within a home before wastewater (containing a mixture of nutrients, pathogens, and trace chemicals) is flushed through a septic tank that separates the solids and liquids (Hoghooghi *et al*., 2021; Lusk *et al*., 2017). The liquid effluent then flows to a septic drain field, where the unsaturated zone of soil acts as a filter before the effluent meets groundwater. Bacteria plays a key role in the efficiency in both the septic tank and drainage field and serve to break down organic materials present in the discharge (Ravi & Johnson, 2021).

The efficacy of these systems is evaluated by the ability of the system to properly filter nutrients, solids, and pathogens before discharging wastewater (Hoghooghi *et al*., 2021). While user error, like excessive water usage and incorrect disposal, can result in system failure, there are also several geographic factors that can impair function. These factors include inappropriate soils, excessive slope, and high water tables in areas where septic systems are installed (Capps *et al*., 2020; Connelly *et al*., 2023; Ravi & Johnson, 2021). System-specific characteristics can also contribute to poor functioning. For example, incorrect sizing of the tank or drain field can occur as systems are not one size fits all. System age can also have a significant impact. The average lifespan of a septic system is 15 to 40 years, with their longevity influenced by the maintenance and volume of waste processed by the system (USEPA, 2017). In 2002, the US Environmental Protection Agency (USEPA) estimated that ~50% of homes on septic are more than 30 years old, which is troubling as septic system failure tends to increase with age. Any combination of environmental and system specific factors can cause impaired function and issues for the surrounding neighborhoods, and state, county, and local health officials. The challenges of managing septic systems are increasingly prevalent as development of rural and suburban regions increases (Ravi & Johnson, 2021).

Septic systems, when functioning properly, provide a variety of economic and environmental benefits. They reduce economic burdens on communities by curtailing large infrastructure and energy costs, which is especially good for those in rural areas. Septic systems also on average use less energy for maintenance than sewers and constantly replenish groundwater, so are considered more environmentally friendly compared to sewer systems (Georgia Department of Public Health, 2018).

Septic systems that are poorly designed, either badly sited or built, not maintained, or undersized, can release harmful pollutants or pathogens to surface and ground waters and pose public health risk by contaminating drinking water supplies or exposing the public to faecal matter (Hernandez & Pierce, 2023). Surveys from the USEPA identify septic systems as the probable source of sewage to almost 19,000 miles of rivers and streams and 190,000 acres of lakes, reservoirs, and ponds (USEPA, 2014). Excess nutrient inputs can accelerate and cause harmful algal blooms, eutrophication, and hypoxic conditions in both marine and freshwaters (Brewton *et al*., 2022; Cooper *et al*., 2016; Withers *et al*., 2014).

Wastewater can also contaminate drinking water and cause negative impacts to human health. Pathogenic organisms can cause illness from ingestion. The most commonly found pathogens in groundwater from sources like septic systems include norovirus, hepatitis A, Salmonella, diarrheagenic E. coli, and Cryptosporidium and Giardia (Murphy *et al*., 2020). Besides impacting drinking water, pathogens and nutrients in water bodies can make these waters unsafe for recreational and agricultural uses. Additionally, if a septic drain field fails, septage may back up into the home or seep out into the surrounding area. Exposure to raw sewage in either of these cases can make both people and animals sick (Washington State Department of Health, n.d.).

Septic systems are not typically monitored by local governments in the US, but are the responsibility of individual owners of systems, i.e., a homeowner, property owner, homeowners' association, or other management entity (Capps *et al*., 2020; Swann, n.d.). This responsibility includes the overall operation, maintenance, and upkeep (including septic pumping and repair) of a system, as well as responsible use of the system, such as regulating what goes down the drain or how much water is used (USEPA, 2023). This can be problematic, as those in charge of systems may not provide sufficient servicing or upkeep of their systems and failing or poorly functioning septic systems can be a risk to public health and the environment. Septic system treatment is also becoming an environmental justice concern because of the prohibitive cost to upkeep, pump, and repair systems (Capps *et al*., 2021).

When thinking about wastewater in the context of the COVID-19 pandemic, many may think back to the use of wastewater surveillance as a tool to monitor the spread of the virus. Much less attention was paid to the unequal impact of insufficient wastewater infrastructure. While US populations faced less of these exposure issues, there were still inequalities in treatment and proper upkeep of wastewater treatment, especially septic systems. There have been anecdotal reports that septic pumping and septic failure increased during the pandemic, because people were confined to their homes and relying more on their private facilities. There are concerning environmental justice implications of this infrastructure gap, as the COVID-19 pandemic generally deepened already existing inequities and it has been found that inadequate management of wastewater was associated with higher COVID-19 mortality rates globally (Dejus *et al*., 2023). Little work has been done to understand empirically which populations were most the most impacted by poor wastewater infrastructure.

Project Goals

My study site is Athens-Clarke County (ACC), Georgia. My work aims to give better insight into trends in sociodemographic characteristics and systems that are ageing which can help target future education and outreach programs in ACC. Additionally, my findings will help inform future infrastructure planning in the county. My goal is to address two research questions: 1. What is the relationship between income and septic system function in ACC? and 2. How did COVID-19 lockdown orders impact septic pumping and repair patterns?

Conclusions

There is an increasing need in the US to understand and quantify the impact and potential failure risks of septic systems, as well as the disparities between septic infrastructures. Local governments would benefit from collecting more data on their septic infrastructure and from making partnerships across offices. Communities would benefit from more education and outreach, especially those that are disproportionally impacted by poor wastewater infrastructure. My work aims to provide insight into environmental justice concerns related to poorly functioning septic systems and to understand the impact COVID-19 lockdown orders had on septic system infrastructure at a local scale, the latter of which has not yet been fully quantified.

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