Wicked Case Exploration Group Work

Wicked Case #1 - The Water Crisis in Flint, Michigan

In a cost-saving measure in 2014, the city of Flint, Michigan switched the supply of their drinking water from the Detroit city system to the Flint River. Shortly after, residents began complaining about brown, smelly, and foul-tasting water, as well as hair loss and skin conditions. Their concerns initially fell on deaf ears, as city and state officials ignored or denied any problem. However, after enough public uproar, investigations, and lawsuits, it was determined that through a failure to treat the water, high levels of lead had leached out of aging pipes into homes. Thousands of residents were exposed to dangerous levels of lead, leading to concerns about a number of health conditions including neurological impairment and outbreaks of bacterial infections. This disproportionately affected people in the poorer areas of the city. After four years of residents using only bottled water, fighting for the health of their families and safety of their water, and trying to determine who is to blame, the crisis is still not fully resolved.

Case Analysis

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Wicked Case #2 - The Use of Antibiotics in Agriculture

Approximately 80% of antibiotics sold in the U.S. each year (by weight) are used in agriculture. While sometimes used to treat infections, they are primarily used prophylactically to protect herds or as "growth promoters" to help animals reach size and maturity faster. With the growing public health concern of antibiotic-resistant bacterial infections, these farming practices are being investigated as creating potential breeding grounds and reservoirs of "superbugs". This has led some companies to begin to change their practices, and there is an increased demand by consumers for animal food products with labels such as "Antibiotic Free" or "Raised Without Antibiotics", without necessarily an understanding of the scientific, economic, and health meanings behind the labels.

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Wicked Case #3 - The Impact of Climate Change on Agriculture, Ecology, and Health

There is abundant scientific evidence that the climate of Earth is rapidly changing. In addition to recent unprecedented increases in greenhouse gases and resultant warming, the atmospheric ozone layer is in worsening jeopardy. The protection the ozone layer affords against UV radiation is decreasing again as certain chlorofluorocarbons, still banned globally, are likely being produced again according to a recent report.

In nature, climate change and its effects on weather patterns can modify the ranges occupied by organisms with subsequent effect on other species including humans. Some species may not be able to compete with new invasives, food webs may change increasing competition, traditional foods may no longer be readily available to indigenous peoples, and diseases can spread to new areas and new hosts.

Human-made systems, such as agriculture, are challenged by climate change. Increase in the greenhouse gas carbon dioxide was originally thought to be a boon to plants. However, it turns out to have a negative effect on the nutritional quality of some plants, as recently reported for certain rice species. Drought related to climate change affects many farming regions of the world, especially those already approaching water insufficiency. Further, some crops are incapable of producing well in higher temperatures. Plant breeding for high temperature tolerance and introduction of new crop plants are adaptation strategies in use, as is human migration.

International policies to curb emissions of greenhouse gases have resulted in a little slowing of the rate of increase, despite lack of policy approval by the U.S. Many social, economic and political issues have yet to be addressed globally as well as region by region, to help humans and ecosystems thrive in a world experiencing rapid climate change.

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Wicked Case #4 - Personal Genomics and Genomic Medicine

The use of home-based genetic testing (think 23&me, ancestry.com, etc.) has become very popular with unanticipated applications beyond just personal information, such as catching serial killers, or supporting claims of white nationalists. The rise of personal interest in genetic information parallels the rise of interest in genomic research and medicine with some interesting overlap.

From the 23&Me web site: "On average, a customer who chooses to opt into research contributes to over 230 studies on topics that range from Parkinson's disease to lupus to asthma and more. With the help of our 23andMe community we believe we can accelerate research and make an impact with our genetic data." The 23&Me web site currently lists 103 research papers published using data from the 23&Me researchers. Whole-genome sequencing is becoming less expensive and available to consumers from a variety of sources costing as low as $999. Researchers like Dr. George Church argue that the costs of genomic testing offset medical treatment costs of severe Mendelian-based conditions like cancers linked to BRCA-1.

Approximately 2 billion human genomes are predicted to be sequenced by 2025, which would make it one of the largest databases in the world. Privacy and misuse concerns linger, with no clear answers to protect personal genomes once they are sequenced. The Genetic Information Nondiscrimination Act was passed in by the US congress in 2008 but does not cover critical topics like long-term disability insurance or life insurance.

With the dramatic rise in access to genomic data, it is becoming increasingly important for people to know how to interpret this data and how it might be used. This is crucial not just for consumers using home testing kits, but also for researchers trying to determine the genetic, epigenetic, or environmental basis of traits, and physicians adapting medical diagnoses and treatments to particular genotypes.

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Wicked Case Exploration Group Work

Wicked Case #5 – Dam Removal and Native Salmon Restoration in Washington State

Dams on the Elwha River in Washington State have blocked salmon migration for one hundred years. These dams are now being removed. For over a century, the web of ecological and cultural connections in the Elwha Valley were broken - then the river's story changed course. In 1992, Congress passed the Elwha River Ecosystem and Fisheries Restoration Act, authorizing dam removal to restore the altered ecosystem. After two decades of planning, the largest dam removal in U.S. history began on September 17, 2011. Six months later Elwha Dam was gone, followed by the Glines Canyon Dam in 2014. Today, the Elwha River once again flows freely from its headwaters in the Olympic Mountains to the Strait of Juan de Fuca. The Lower Elwha Klallam Tribe is looking forward to having its treaty rights to fish from the Elwha River restored. Is it possible for the wild salmon and steelhead to recolonize the River after more than 100 years of dams blocking their migration route? Should the Lower Elwha Tribe's treaty right to catch fish continue to be denied while passive recolonization by wild salmon takes place?

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