Science, Society and Risk in the Anthropocene

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The culture of too much hygiene in rapid, unplanned urbanising society with poor infrastructure exposes urban spaces to a particular risk brought about by unchecked use of technology. This article looks at the indiscriminate use of antibiotics and antibacterial consumer products, which form the aetiology for the emergence of new strains of antibiotic resistant bacteria (superbugs) in urban space, especially in waterbodies.

In its report on antimicrobial resistance, published on 30 April 2014, the World Health Organization (WHO) has declared that bacterial resistance to antibiotics is a major health issue threatening all regions of the world. The report emphasises preventing infections from occurring with better hygiene and by improving access to sanitation and clean water (The Hindu 2014). The onus of the risk of emergence of antibiotic resistant strain of bacteria has been located in inappropriate antibiotic drug usage. Very little attention has been paid to the consumer products, which claim to be “antibacterial” and to keep the environment 99.9% germ free.

In 1968, American marine biologist and conservationist Rachel Carson wrote The Silent Spring, a path-breaking book on indiscriminate use of chemicals in the US. It was for the first time that the idea that if human beings were going to adopt new technologies without assessing or evaluating the long-term impact of their usage, then we as a race were staring at disaster, was put forth. Technology has already brought about irreversible challenges to the quality of life of plants, animals and human beings.

But nature finds its own way and it has started fighting back against the technology. For instance, rootworms have modified their genetic programming to survive and continue to consume corn genetically modified to poison them (The Times of India 2014). Strains of bacteria, seemingly subdued by technology, have developed resistance to antibiotic drugs, termed as superbugs. Thus it can be inferred that the culture-nature borderline is so entwined that change in one creates a paradigm shift in the other. As Donna Haraway, a prominent scholar in the field of science and technology studies, puts it,

There is no border where evolution ends and history begins, where genes stop and environment takes up, where culture rules and nature submits or vice-versa (Haraway 2004).

Industrialisation, urbanisation and modernisation are key indicators of development. Science and technology have been recognised as tools and engines of socio-economic progress, growth and development. Human changes to land, water, and biosphere and to the climate of the earth are so intensified and rapid that it can be said that humans are
central to the crisis of nature. However, science, commerce and politics as key institutions of modernity are no longer assured the rationality and security with which they were supposed to be deployed. Instead, in this changed scenario, they have portrayed themselves not only as a contrivance of risk management but also as a cradle of “world risk society” (Beck 1992, 1999).

To demarcate this new epoch in the history of the earth, atmospheric chemist Paul Crutzen and biologist Eugene Stoermer coined the term “anthropocene”. According to them, the invention of the steam engine in the 17th century was a major breakthrough in the life of the planet. With the invention of the steam engine, human aspiration for progress flourished as a substantial “geological and morphological force” (Kirksey and Stefan Helmreich 2010). The use of steam power led to factory production, wide-ranging manufacturing of machine tools, large-scale use of machinery, and a revolution in transportation. With a spate of new innovations, technology managed to affect nearly every aspect of human life. In this scenario, interaction with nature to fulfill human needs gradually turned into control, transformation and exploitation of nature to satisfy human greed. This change leads humanity to an unforeseeable and risky world, in lieu of a more certain and secure world.

Though bacterial resistance to common antibiotics has been a worldwide concern, antimicrobial resistance has been an especially major public health problem in south-east Asian countries (Bhatia and Narain 2010). In India, the infectious disease burden is among the highest in the world. Recent reports showed that the inappropriate and irrational use of antimicrobial agents against these diseases led to increase in development of antimicrobial resistance (Kumar et al 2013). The etiology of this resistance has been recognised by WHO (1996) in the relatively easy access to and higher consumption of medicines, which have increased the probability of overuse of antibiotics.

In India, the problem has been observed across three main classes of superbugs; Methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa, bacteria of genus Acinetobacter and family Enterobacteriaceae. One recent addition in this series is the New Delhi Metallo-beta-lactamase-1 (blaNDM-1) enzyme which makes bacteria resistant to a broad range of beta-lactam antibiotics – eventually carbapenem antibiotics. In 2010, NDM-1 positive isolates and blaNDM-1 genes were detected in surface waters across Delhi and have since been detected across the urban realm of the rivers (Yong et al 2009). This NDM-1 was first detected in a Klebsiella pneumoniae isolated from a Swedish patient of Indian origin (ICMR Status Report, 2011). The most common bacteria that make this enzyme are gram-negative, such as Escherichia coli and Klebsiella pneumoniae, but the gene for NDM-1 can spread from one strain of bacteria to another by horizontal gene transfer. The latter is transfer of genes among organisms of the same generation, by means other than reproduction (vertical transfer). Thus, high rate of reproduction and the aptness to pass genes among themselves, mean rapid growth of superbugs.

According to the Status Report 2011 of Global Antibiotic Resistance Partnership (GARP) – India Working Group, use of antibiotics has increased gradually in recent years. This report further added that between 2005 and 2009, sale of antibiotics increased by 40% (GARP 2011).

Recent research by Ziaddin S Ahammad et al (2014) has shown that the abundance of waterborne blaNDM-1 gene is associated with the seasonal human pilgrimages to the upper Ganga River. The researchers have argued that blaNDM-1 abundance was very low across all sites in February in the upper Ganga and the water quality was good. However, per capita blaNDM-1 levels were 20 times greater in June in the Ganga water column, when compared to February. The blaNDM-1 levels significantly correlated with the feecal coliform levels. They argue that pilgrimage areas without adequate waste treatment are possible “hot spots” for antibiotic resistant transmission. They suggest that waste treatment must be improved to reduce broader antibiotics resistant dissemination from exposed returning pilgrims (Ahammad et al 2014).

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It is expected that India’s urban population will go up from 377 million in 2011 to 600 million by 2031. This is an increase of over 200 million in just 20 years. Such rapid urbanisation is posing serious challenges to basic requirements of water and sanitation, etc.

According to the Census 2011, only 70.6% of urban population is supplied by piped water connections. About 13% of the urban population defecates in the open, open drains connect 37%, and 18% are not connected at all (COI 2011). Infectious disease burden in India is among the highest in the world, and poor sanitation and malnutrition increase susceptibility to disease.

We are living in a second, reflexive age of modernity or risk society (Beck 1992, 2006) defined as all pervasive of low prospect-high consequence technological risks. Reflexive modernity or risk society can be defined as an understanding of living in a society of increasing susceptibility to the unique, unintended, unknowable and unforeseen risks contrived by modern science and technology. Beck (2006) also consents to the fact that “risk society” is not just the outcome of unpredictable, unprecedented effects of the technology but it also epitomises the consequences of political decisions to strive for development and employ technologies to achieve reprehensible aims.

Against this backdrop, well-being has predominantly become more about protection from risk. In recent years, there has been increased awareness about the harmfulness of using pesticides and other chemical fertilisers. More people have started turning to organic food to avoid chemicals and adulterants. On the one hand, after understanding the impact of pesticides and other chemical fertilisers on human health, emphasis on use of organic food has been increasing, on the other, even a normal, natural phenomenon like growing older is being viewed as a risk by modern society. So almost daily we have new ranges of medicines and cosmetics being marketed, claiming to delay ageing, if not to fully stop it.

Germ-Free and Sparkle

However, germs have become the axiom for a risk people want to jettison from their milieu. This view has opened the door for industrialists to cash in on this fear and produce an array of products designed to eradicate these germs. The desire to keep the domestic arena free from germs and bacteria and as clean and sparkling as possible has accelerated the use of antibacterial household products. This germ-free and sparkly, however, causes a lot of harm when this chemical load enters our sewer system. This has increased chemical load on the sewage system. With inadequate treatment facilities, it has now led to severe pollution of rivers.

However, the consumption pattern has been believed to be significantly shaping middle-class culture and identity. This is not only about safety, it also reflects the longing of the middle classes to distinguish themselves from the poorer classes. Susan Chaplin (1999) in her paper says the availability of new medical technologies, such as antibiotics, allows India’s wealthy to insulate themselves from the effects of poverty (in this case the threat of infection). This has given rise to the culture of heavy consumption of anti-bacterial products, which claim to make the body ultraclean and the surroundings, sanitised. Cities, towns and villages are being flooded with advertisements for...
sprays, lotions, soaps, cleansers, toothpastes, dishwashing detergents, and many such products containing antibacterial agents. In response to these commercials, people are buying antibacterial products because they think these products offer health protection. The society, which wanted to be clean, now wants to be super clean. Consumers are sold on 99.9% removal of ambient germs. So the aspiration to have a 100% germs-free environment has become an opportunity for the producers of such products.

Most of the consumer liquid products labelled as antibacterial comprise Triclosan. The chemical name of Triclosan is 2, 4, 4-Trichloro-2-hydroxydiphenyl ether. Triclosan is a phenoxypenol antimicrobial that is marketed as an “antibacterial” ingredient in consumer hygiene products, but it also has some antiviral and antifungal actions. It is bacteriostatic at low concentrations and bactericidal at high concentrations (Allison et al 2007). In 1969, the US registered Triclosan as a pesticide. For the next 20 years, it was common in medical settings, but in the 1990s, addition of Triclosan in consumer products rose steeply. After the economic liberalisation in 1991, Indian markets were also flooded with such products.

According to researcher and physician S B Levy (2001) “A Triclosan-resistant mutant of E coli does not lyse easily in the presence of Triclosan, making the strain difficult to kill”. He cautioned that bacteria might become immune to Triclosan (Levy 2001), which consequently, may be etiology for cross-resistance to antibiotics, and for the ingredients to become toxic to the environment and to humans (Allison et al 2007).

Levy has reported that Peter Vikesel and his colleagues found that the Triclosan antimicrobial agent used in household dishwashing soaps reacts with chlorinated water to produce unacceptable high levels of chloroform, which is known to be a probable human carcinogen. The research also suggests that the reaction of Triclosan with chlorine could be producing highly chlorinated dioxins in the presence of sunlight.

**Conclusions**

Many scholars have perceived the risk in the emergence of new strains of antibiotic-resistant bacteria due to inappropriate antibiotic drug usage. But the scientific world also needs to pay attention to the dangers from consumer products, claiming to be “antibacterial”. The desire to have an extremely hygienic surrounding and “hospital-like” (Levy 2001) cleanliness at home is only going to add more and more chemicals to our rivers. Our rivers are the ultimate destination for treated, semi-treated and untreated sewage from our cities. In developing countries, unplanned urbanisation and indiscriminate use of antibacterial agents will lead not only to grave health problems but also to serious environmental issues.

Rapid and unplanned urbanisation coupled with heedless consumerism has exposed our urban space and urban water bodies to a particular risk brought to us by unchecked use of science. I am not arguing against the use of science. But my argument is against such public imagination where contributions of science are only technologies – the things that provide the mastery over nature (Bernard 2006), instead of knowledge and understanding of the natural process. It is high time we learned a lesson or two from our previous experiences of extensive use of chemicals in the form of fertilisation during the green revolution and the impact it had on the soil and people of the region. The whole trajectory of development has shown that we have not learned from our mistakes and are bound to face the nastiest consequences of our mistakes. As George Santayana (1980) wrote, “Those who cannot remember the past are condemned to repeat it”.

**REFERENCES**


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