



Diarrhoea in Senior Citizens

The Hidden Public Health Challenge

IN a paper published in *PLOS ONE*, researchers from the International Institute of Population Sciences, Mumbai, found that 15% of senior citizens in India suffered from diarrhoeal diseases. This number varies widely and has a very clear state, rural-urban, caste, and economic divide. Given that India has the third-highest older adult mortality rate due to diarrhoea, this often-ignored problem deserves immediate attention especially as the older adult population continues to increase at an accelerating rate.

Diarrhoea is a very common disease and is often known as an infant killer due to the high number of deaths it causes in children under the age of five years. It is caused by viruses or bacteria that are often associated with poor sanitation facilities and unclean drinking water. Due to international and national efforts, the infant mortality rates due to diarrhoea have been going down in India in recent years.

But an often-overlooked section also faces the same risks due to diarrhoea: senior citizens. Data suggests that in adults over the age of 70, mortality rates due to diarrhoea can be as high as three times that of infants. According to a study published in *The Lancet*, India had the third-highest rate of older adults' mortality due to diarrhoea in the world at 1013 deaths per 1,00,000 older adults. Not only does diarrhoea have high rates of death in senior citizens, it also causes emotional distress and fear in senior citizens as they may feel helpless to control the disease.

Given how ignored this subject is in Indian research and policy efforts, researchers from the International Institute of Population Sciences set out to find actual rates of diarrhoea in older adults, the risk factors related to it, and the differences between states. They used the data collected by the Longitudinal Ageing Study in India (LASI), which was a full-scale, national survey aimed at studying the health and well-being of older adults in India. The researchers looked at the data of the 31,464 respondents who were above 60 years of age.

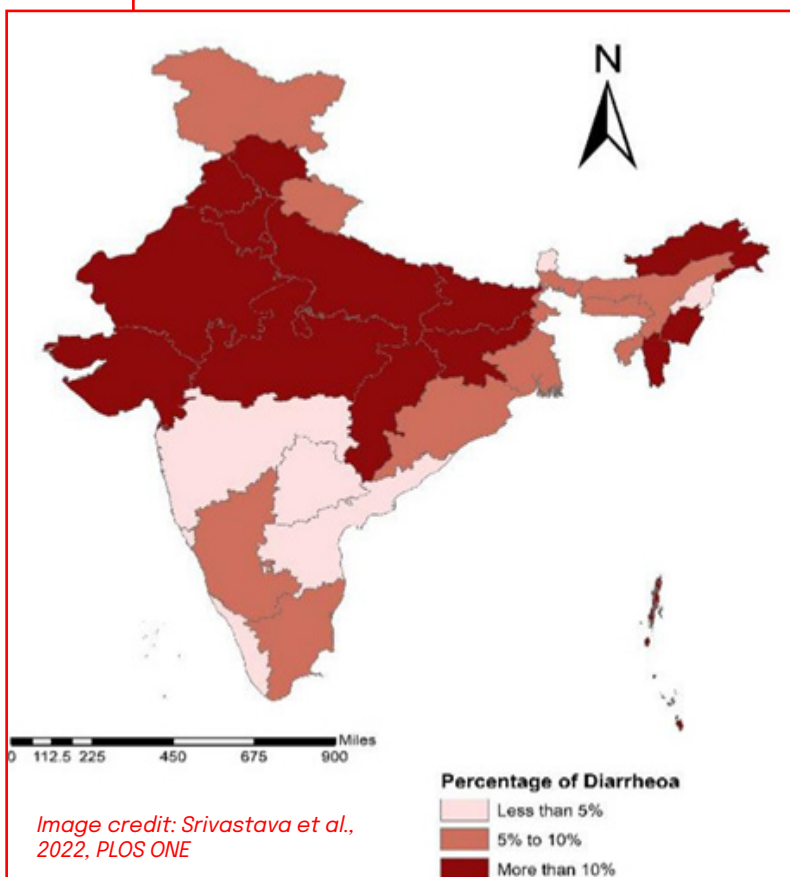
It was observed that the prevalence of diarrhoea was highest in adults over 80 at 17.6% than any other age group. Similarly, older females were more likely to have suffered from diarrhoea than older males. Members from marginalised communities have higher risks than others. It was also observed that lack of improved drinking water sources and toilet facilities, malnourishment, and the use of unclean cooking fuel were all associated with higher rates of diarrhoea.

These rates were also unevenly spread across zones. Central India had the highest rates, followed by North and East India. The lowest rates were observed in Southern India followed by Western India and the Northeast. This is also seen in state-wise distribution with Mizoram having the highest rates (33.5%) followed by Chhattisgarh (30.7%), Bihar (30.2%), and Rajasthan (30.2%). Finally, the biggest countrywide difference is in the rural-urban difference, with rural rates (17%) almost two times that of urban rates (9%).

The authors suggest that more research should be done to find more granular data over time and help policymakers make more accurate decisions. India's population of senior citizens is set to increase from 8% in 2015 to 19% by 2050. Thus, diarrhoea in older adults is set to become a bigger public health concern, especially because it is a preventable disease. Since it is caused by public health challenges such as poor sanitation and unclean drinking water, the responsible authorities must put in place policies that can tackle this huge public health problem and rectify the historical overlooking of this problem.

The published paper can be accessed on *PLOS ONE* website.

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Microbial Literacy Need of the Hour

MICROBES are everywhere around us! The human microbiome is made up of trillions of bacteria that reside in and on our bodies. Humans, after all, are 50% microbial (Sender *et al.*, 2016; Timmis *et al.*, 2019), therefore, it's no surprise that the human microbiome is a contentious issue in health research.

Microorganisms are thus crucial not only for humans, but also for animals and plants, and they play an important role in ecosystems. The Earth would suffer a catastrophic de-greening if these robust microbes, which feed nitrogen to plants, were not there. If these small bacteria vanish, people will perish as well. Such an intricate relationship is full of paradoxes, however. Some microorganisms can cause illnesses or diseases, but other microorganisms are essential to good health.

Unfortunately, most people are only aware of their detrimental effects on human health as a result of prevailing misinformation. This misleading testimony is also supported by the current epidemic crisis. The same epidemic, however, has highlighted the significance of including microbiology in the basic school curriculum and raising public understanding of the role of bacteria in our daily lives.

To debunk these myths about microbes and overcome microbe phobia, a mission towards 'microbial literacy', in which key aspects of microbiology are incorporated into the basic framework of education curriculum, from kindergarten to primary, secondary, and high



school levels, becomes critical. This can be accomplished through close collaboration between policymakers and educators. This purpose can be translated rather well using a child-centric approach, as young minds are sensitive to most rational ideas and observations.

Microbial literacy becomes even more important in light of the current reluctance to move forward with a vaccine against COVID-19, as well as the alarming rise in antimicrobial resistance cases due to antibiotic misuse or overuse, demonstrating the amount of groundwork that needs to be done in the direction of making people literate about key aspects of microbiology.

We must use all available resources to explain the importance of microbiology clearly and appealingly to effectively contribute to microbial literacy.

Nursery rhymes, for example, can be made employing novel ideas in which germs are braided in a pleasing pattern to correspond to the relevant topic. Classrooms can be illustrated with pictures or charts or models of microbes. Children can be encouraged to make kitchen compost along with their kitchen garden as part of activity-based home assignments. The inclusion of exercises based on 'kitchen microbiology' will help students to learn that many substances (such as bread, cheese, yoghurt,

vinegar, olives, pickles, sour cream, coffee beans, etc.) found in the kitchen, which are part of their daily life are made by the action of microbes. Also, Scavone *et al.*, 2019 has suggested the use of comics/cartoons for microbiology as these are quite popular among children. These science comics can be used to address a variety of microbiological issues in a fun and practical way.

In addition, excursions or local outings to oceans, ponds or lakes, wastewater treatment facilities, cheese or winemaking industries, etc., will greatly help to stimulate the curiosity of children and ignite their minds to raise questions about microbial activities and the impact on their lives.

The real essence of microbial literacy should not be on making our students well equipped with the tools and techniques used in the discipline of microbiology and become 'microbiology professionals or specialists', but rather the intent should be on empowering the students to make their daily decisions based on the basic knowledge and understanding of concepts related to microbiology — or microbial literacy.

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Creator of “Chaos” Bags Abel Prize-2022

TOPOLOGY (from the Greek words meaning “place”, “location” and “study”) emerged as a new field of geometry in the 19th century, when mathematicians started looking more closely at the essential properties of shapes. According to it, two objects are considered to be the same, if one of them can be turned into the other by stretching or squeezing but without tearing or glueing. Therefore, in it, the letter “a” is considered the same as “b” or a square is the same as a circle.

Now, topology is used in many branches of mathematics, physics & biology as well as in computer science and robotics. A basic concept in topology is the “manifold”. It is a shape that is same everywhere, meaning that it has no endpoints, edge points, crossing points or branching points. Manifolds can be classified depending upon how many different types of manifolds are there and what they are like. It has become one of the fundamental areas of research in topology today.

This is the area in which Dennis Parnell Sullivan of Stony Brook University, USA, and the University Centre of the City University of New York, who has won the Abel Prize-2022 had begun his work. According to the Abel Committee, which announced the prize, it

has been awarded to him “for his ground-breaking contributions to topology in its broad sense and in particular, its algebraic, geometric and dynamical aspects.

Sullivan was born in Port Huron, Michigan on 12 February 1941. After completing his graduation from Rice University (1963), he worked on the classification of manifolds under the guidance of William Novikov of Princeton University, who was well-known for his contributions to topology. There, Sullivan developed the techniques to provide insights that revolutionised the area. Thereafter, he introduced new ideas in algebraic and geometric topology and wrote a set of notes which were considered to have direct impacts on the classification of smooth manifolds and central problems in algebraic topology. Called as MIT notes these were published in 2006.

In the late 1970s, Sullivan started to work on problems in dynamical systems. It involved the study of a point moving in a geometric space, a field considered far removed from algebraic topology. He created an explosion of interest in this field called “Chaos Theory” since many of the dynamical systems exhibited chaotic behaviour.

Then along with Moira Chas, in 1999 he discovered a new variant for a manifold based on loops, creating the field of string topology. He also proved Adam’s conjecture. Of his most important contributions to the field the Connes-Donaldson-Sullivan-Teleman index theorem, the Parry-Sullivan invariant, the Sullivan conjecture, the Density conjecture, the Localisation of a topological space, No-wandering domain theorem, the Rational homotopy and the String topology are worth mentioning.

The chairman of the Abel Committee has justified selecting him for the award with the words, “Dennis P. Sullivan has repeatedly changed the landscape of topology by introducing new concepts, proving landmark theorems, answering old conjectures and formulating new problems that have driven the field forward”.



Dennis Parnell Sullivan

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Indian Jackal

The Night Howler

OUR encounter with the Indian jackal (*Canis aureus indicus*) also known as the Common jackal, Asiatic jackal, Himalayan jackal or Golden jackal is very recent as we shifted from Mumbai to our university campus situated at Kumarganj, a small village in eastern Uttar Pradesh. Nearly every day after the fall of dusk, we can distinctly hear the prolonged, high-decibel 'powwow' in our campus.

When I (the first author) first heard the collective howls, it startled me. What sounds like an eerie combination of babies screaming and crying is their mode of communication with the pack.

The Indian jackal is tawny coated with light-coloured underparts. This species has a wide geographic range, occurring from North and East Africa, Southeastern Europe and South Asia to Burma. They are found in diverse habitats ranging from evergreen forests, dry deciduous forests, grasslands, semi-arid regions, and agricultural areas to human-dominated areas.

They are strictly monogamous and live in mated pairs accompanied

by 'helpers' which forms the basic social unit. 'Helpers' are jackals who stay with their parents for almost a year even after reaching sexual maturity, without breeding, to look after the next litter of their parents.

This species rear their pups in dens and have multiple dens with multiple openings to escape from predators. This is a highly territorial species and marks it with urine and faeces. They have a keen sense of hearing and usually hunt in pairs. Being omnivorous, they feed on small mammals, birds, insects, grass, leaves and fruits. As they feed on fruits, they have an important role in the ecosystems as seed dispersers. They spread the seeds in the form of droppings far and wide and thus help in the reproduction and survival of trees.

Another ecosystem service provided by the jackals is as scavengers, since they are opportunistic feeders. It is not rare to see Indian jackals feeding on household waste, leftovers and livestock carcasses. The saying, "It is better to live like a lion for a day than a jackal for 100 years" originated from the scavenging behaviour of jackals.

Scavenging in human-waste food brings them in close proximity with the free-ranging dogs leading to competition, disease transmission (rabies) and hybridisation (interbreeding

between dogs and jackals). Jackals have always been in the bad books of humans as they raid poultry farms and sugarcane fields, giving rise to conflict with humans. This usually ends in poisoning the jackals with poison-laced baits. Another threat faced by this species is illegal poaching and trade.

The Wildlife Crime Control Bureau seized 126 jackal skins, 8 tails, 16 skulls, more than 370 jackal horns and two live jackals in a duration of six years (2013 to 2019) from various parts of India. The jackals are poached for meat, their pelts are used in the fur trade, their organs in traditional medicine, and their nails, teeth, skulls and tails are used as lucky charms by black magic practitioners. Jackal horns or "Siyar Singhi" is a product claimed to be derived from the head of the jackal and easily available for sale. This is most likely a fake product and is considered a lucky charm by black magicians. It is likely to be a deformity on the jackal's head or it can be an artificial product where a ball made by mixing and glueing together mud, skin and tufts of hair of jackals or goats is attached to carved pieces of cattle horns or hooves.

Though this species has a stable population in India, its future is bleak due to the increasing cases of wildlife trade. The illegal trade of jackals for its fake product "Siyar Singhi" is quite unfortunate. It is sad that its dual ecosystem services remain under-appreciated and it remains infamous as a poultry-killer.

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a) Indian Jackal, b) Pack of Indian Jackal, c) Indian Jackal feeding on household waste and leftovers, d) Indian Jackal found in sugarcane field