

A Note on Infectious Diseases with Special Reference to COVID-19

Year of Awareness on Science and Health (YASH) 2020-2021

National Council for Science & Technology Communication (NCSTC), Department of Science & Technology launches a programme on health and risk communication “Year of Awareness on Science & Health (YASH)” with Focus on COVID-19.

Important objectives of the YASH programme are:

1. To minimize risks at all levels with help of public communication and outreach activities at large.
2. To promote public understanding of common minimum science for community care and health safety measures like personal sanitation and hygiene, physical distancing, and maintaining desired collective behaviours, etc.
3. To develop and disseminate science communication software, enhance science coverage in mass media including illustrative interpretations especially to reduce the fear of risks and build confidence with a dose of necessary understanding.
4. To assess and rationalize community preparedness and perceptions.
5. To inculcate scientific temper for adopting sustainable healthy lifestyles, and nurturing scientific culture among masses and societies.

At the dawn of the year 2020, a fragile uninvited guest, weighing in attograms, was waiting at global doorstep since previous night. Before we could even realize, this cousin of SARS corona virus of 2003 gained entry into our lives, so deeply, that months-long lock-down is not proving to be enough to evacuate this intruder. Our health, health care system, and preparedness for health emergencies came

under scanner. Being completely unknown, this intruder provided no clue, whatsoever, to counteract. Though not of this scale, but we have suffered from a number of outbreaks, endemics, epidemics, and pandemics during last century. The last tragedy of this proportion was recorded almost a century ago. Bottom line is how much have we learnt from our past mistakes. To start afresh, here we are. NCSTC division of DST, GoI has taken an initiative through launching of a program – YASH.

Following insights are expected to give a better understanding and reinforce our preparedness.

Emerging and re-emerging infectious diseases of public health importance:

George Santayana pronounced that “those who cannot remember the past are doomed to repeat it” has a biological corollary: The belief that we’ve vanquished our ancient microbial enemies leaves us alarmingly vulnerable to them.

Infectious diseases dominate public health problems of the 21st Century. Around one-fourth of the fatalities occurring worldwide are caused by microbes and the proportion is significantly higher in the developing countries. Though there has been a remarkable progress in the prevention, control

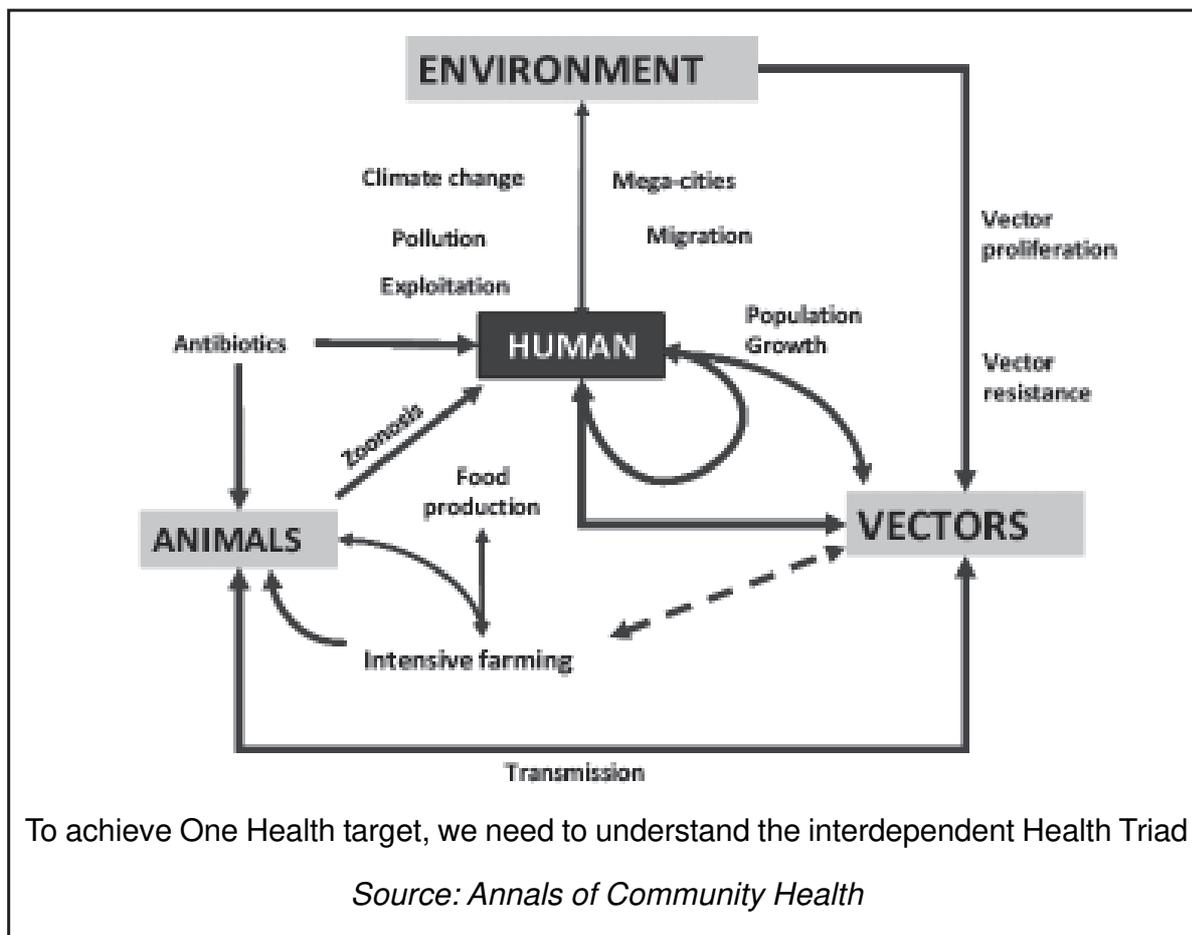


and even eradication of infectious diseases with improved hygiene and development of antimicrobials and vaccines but sadly, with optimism came a false sense of security, which has helped many diseases to spread at alarming rate. India is majorly threatened by emerging and re-emerging zoonotic diseases, food borne and waterborne diseases and diseases caused by multi-resistant organisms.

“Emerging infectious diseases are those due to newly identified and previously unknown infections which cause public health problems either locally or internationally”

During last three decades, more than thirty new diseases emerged threatening the health of hundreds of millions of people.

Though causative agents of emerging infectious diseases have mainly been virus (Rota, Parvo, Ebola, Hantaan, Human Immunodeficiency, Hepatitis E, Hepatitis C, Influenza A - H5N1, H1N1, Corona, Nipah), but even bacterial and prion diseases emerged as endemics. The disease in question involves all the major modes of transmission i.e. spread either from person to person, by insects or animals or through contaminated water or food.



“Re-emerging infectious diseases are those due to the reappearance and increase of infections which are known, but had formerly fallen to levels so low that they were no longer considered a public health problem”

Re-emerging infectious diseases had often appeared as epidemics. Examples of such diseases include Tuberculosis, Cholera, Chikangunya, Dengue, Malaria, Nipah virus infection.

Responsible Factors

The factors responsible for emergence and re-emergence of infectious diseases include unplanned and under-planned urbanization, overcrowding and rapid population growth, poor sanitation, inadequate public health infrastructure, resistance to antibiotics, increased exposure of humans to disease vectors and reservoirs of infection in nature, rapid and intense international travel, relaxation in immunization practices, deforestation, failure to control carriers or breakdown in water and sanitation systems, changes in genetic make-up of the pathogen, and high-risk human behaviour and lifestyle



Challenges

Health perceptions play an important part in ensuring sound health outcomes.



To a great extent these notions are culturally determined but also subject to change with economic growth and social development. People intuitively develop capacity to make choices of being treated under the modern or indigenous systems of medicines, keep a balance between good habits traditionally developed for healthy living and modern lifestyles, decide on where to go for chronic and acute care and how to apportion intra-family utilization of healthcare resources.

The factors and challenges as mentioned hereinabove surfaced conspicuously during COVID-19 pandemic.

COVID-19 – in a nutshell

Today, entire humanity is suffering from the **pandemic infectious disease, COVID-19**, caused by a newly discovered **corona virus**. Primarily, **spread** of this disease is through droplets of saliva or nasal discharge when an infected person coughs or sneezes.

Since COVID-19 is an **emerging contagious** infection that has no known specific treatment or vaccination, the best way to prevent and slow down transmission is to exercise certain etiquettes while sneezing or coughing (like covering mouth and nose), **washing hands** with soap and water, and / or using alcohol-based sanitizer frequently, and avoid touching the face. **Isolation** or **quarantine** of the patients, as per medical advice, and practicing **social distancing** could also limit the spread of the disease.

In most of the cases, the patients suffer from mild to moderate respiratory illness and recover without requiring special treatment. However, senior citizens, those with underlying medical conditions involving heart related complaints, diabetes, chronic respiratory disease, cancer, and with low **immunity** are more likely to develop serious illness resulting in death. People with fever, dry cough or difficult breathing should immediately seek for medical attention and under any circumstance refrain from **self-medication**.

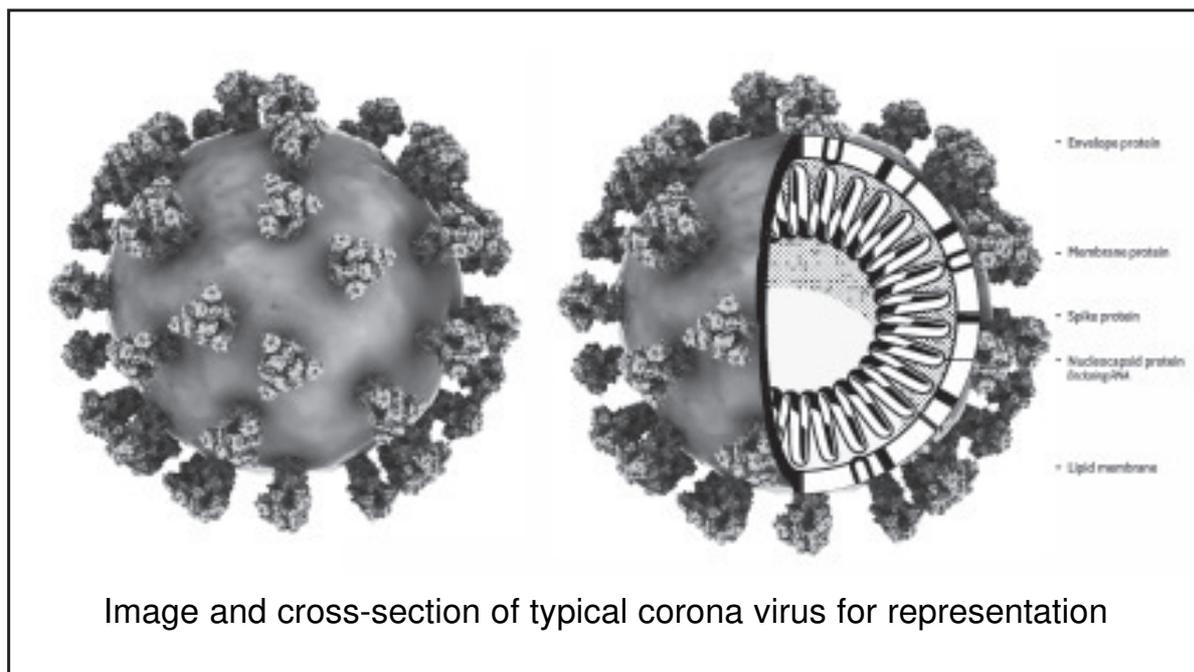


Image and cross-section of typical corona virus for representation

Highlighted terms are being explained (in order of appearance) here under;

Pandemic

Depending on severity of an illness, prevalence, incidence, and the known or unknown disease pathways there are different levels on which a disease event is described. Let us understand these levels one by one;

Sporadic is used to describe infrequent irregular occurrence of any disease, for example outbreaks caused by food borne bacteria like Salmonella or E. coli

When a large number of persons are affected even though the cause is uncertain, for example cancer cases after chemical plant disaster, such an occurrence is referred to as Cluster

A disease is said to be Endemic when it has constant presence and/or usual prevalence in a geographical population. An endemic outbreak occurs at a predictable rate in a certain area or among a set of population. Malaria and chicken-pox are examples of endemic diseases

However, when any disease is persistent and at higher levels in certain population over others, it is referred to as Hyperendemic. For example, HIV is hyperendemic in parts of Africa, where one in every five adults suffer, but endemic in USA, where one in every three hundred are infected

Epidemic is when suddenly a large number of cases are reported, which are more than what is expected from an area. Rapid spread of epidemic among large population takes a fortnight or less, and generally it may be the consequence of natural disasters like storms, earthquakes, floods, or droughts. Examples of epidemic outbreaks include viral diseases like Ebola, Zika, SARS, Chikungunya, Dengue

Though by definition, Outbreak and epidemic are similar but outbreak is more limited geographic event. Initially, when more than expected infected cases are observed in an area, an outbreak is declared. The area could be either a small community or even extended to several countries. Outbreak could be of emerging or re-emerging disease, lasting for a few days to several years, and transmitted through human to human, animal to human and *vice versa*, or from the environment

An epidemic of an emerging infectious disease that spreads over several countries or continents, usually affecting a very large population, is said to a **Pandemic**. Examples of pandemic from yesteryears include cholera, small pox, bubonic plague, influenza and the recent ones like HIV/AIDS, H1N1, H5N1, COVID-19

Infectious disease: Any condition that impairs the normal body functions is termed as a disease, and when it is caused by pathogenic (disease causing) microorganisms, such as, bacteria, viruses, parasites, or fungi and that spread directly or indirectly, from human to human or animal to human and vice versa, is said to be an **Infectious disease**. In short, infectious disease is communicable, which can infect anyone

COVID-19

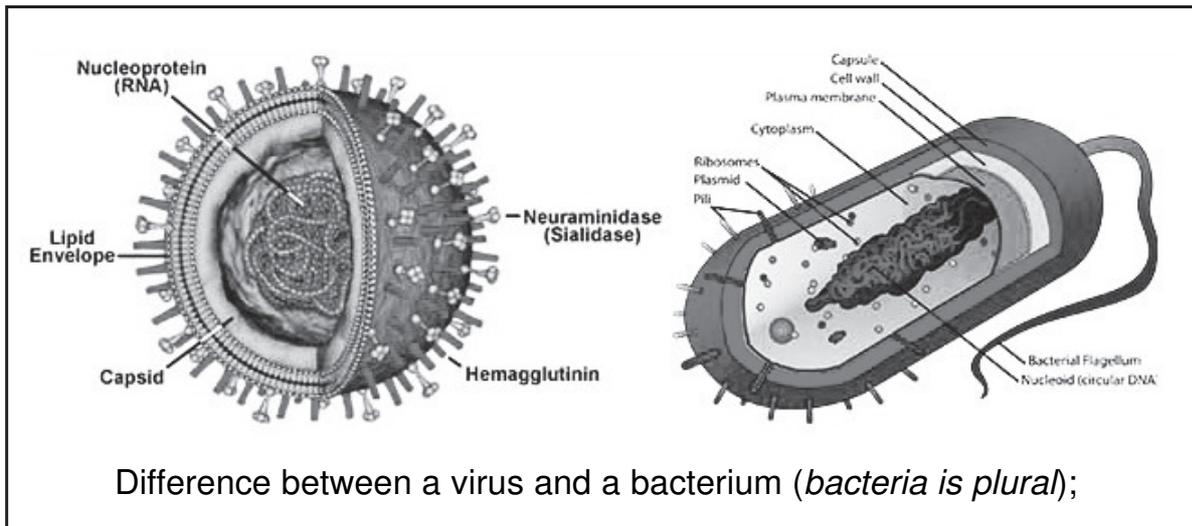
On 11 February 2020, ICTV (International Committee on Taxonomy of Viruses) and WHO (World Health Organization) declared the name of new/novel corona virus disease as **COVID-19**. It is an acronym for **CO**rona**VI**rus**D**isease that appeared during the year 2019. COVID-19 is a disease caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2)

Corona virus: **Corona virusis** an enveloped single-stranded RNA virus that causes disease in vertebrates, particularly in mammals and birds. Corona in Latin means 'crown' or 'wreath'. Electron microscopic images of corona virus show the virus having a fringe of large, bulbous projections on the surface creating an impression that of a crown. Virus in Latin means 'poison'. Considered to be in between living and non-living entities, virus is a genetic material of microscopic size (much smaller than the bacteria), acting as an infectious agent, which cannot replicate of their own but only in the truly living cells.

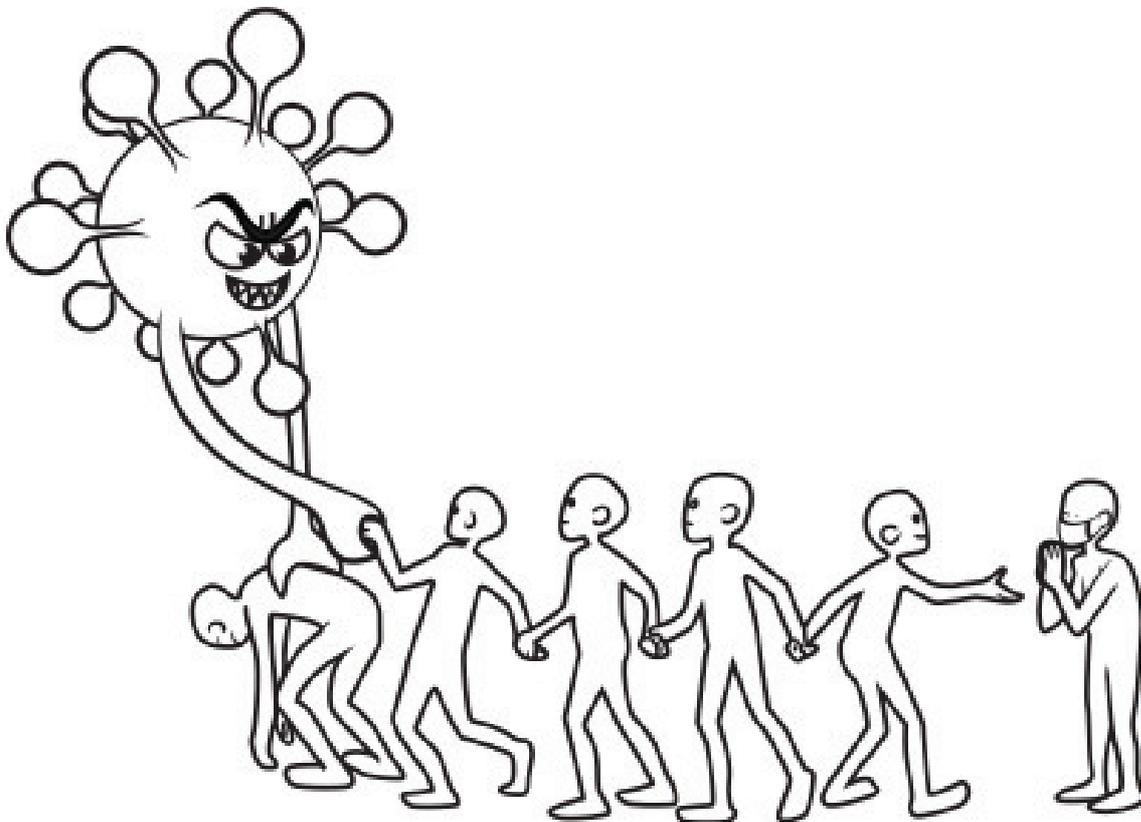
In humans, corona virus affects respiratory system causing common cold, which is typically mild, however the rare forms that result into death, such as SARS (Severe Acute Respiratory Syndrome), MERS (Middle East Respiratory Syndrome), and COVID-19. Symptoms of corona virus vary in other species; in poultry it causes upper respiratory disease, while in cows and swine it causes diarrhea. There are no vaccines or treatment available for prevention or cure of human corona virus infections.

Difference between a virus and a bacterium (*bacteria is plural*)

| Characteristics | Virus | Bacterium |
|------------------------|--|---|
| Size | Smaller (20-400 nm) | Larger (1000 nm) |
| Cell Wall | No cell wall, instead a protein coat is present | Made up of Peptidoglycan or Lipopolysaccharide |
| Ribosomes | Absent | Present |
| Number of cells | No cells | One cell (Unicellular) |
| Living/Non-Living | Between living and non-living | Living organisms |
| DNA and RNA | DNA or RNA enclosed inside a coat of protein | DNA and RNA floating freely in the cytoplasm |
| Infection | Systemic | Localized |
| Reproduce | Need a living cell to reproduce | Able to reproduce by itself |
| Reproduction | Invades a host cell and takes over the cell causing it to make copies of the viral DNA / RNA. Destroyed host cell releases new viruses | Asexual reproduction by Fission |
| Duration of illness | Most viral illnesses last 2 to 10 days | A bacterial illness commonly will last longer than 10 days |
| Fever | A viral infection may or may not cause a fever | A bacterial illness notoriously causes a fever |
| Under Microscope | Visible only under Electron Microscope | Visible even under Light Microscope |
| Benefits | Viruses are not beneficial. However, a particular virus may be able to destroy brain tumours. Viruses can be useful in genetic engineering | Some bacteria are beneficial (Normal gut flora) |
| Treatment | Virus does not respond to antibiotics. | Antibiotics |
| Examples | HIV, Hepatitis A virus, Rhino virus, Corona virus | <i>Staphylococcus aureus, Vibrio cholerae</i> |
| Diseases/ Infections | AIDS, common cold, influenza, chickenpox, and others | Food poisoning, gastritis and ulcers, meningitis, pneumonia, and others |



Spread: Spread or transmission of infectious diseases, particularly, is through direct or indirect contact. Direct contact includes person to person contact, and droplet spread, while indirect transmission could take place through airborne pathogens, touching contaminated objects, consuming contaminated food and water, animal to human contact, vector borne transmission, and environmental reservoirs like contaminated soil.



Emerging: Emerging disease is the one that is caused by a newly identified and previously unknown pathogen affecting public health either locally or internationally. However, when any pathogen known for some time and had reduced to such a low level that these were no more considered as public health concern, have started showing upward trend in incidence or prevalence either globally or have appeared in the areas where these were not found previously cause re-emerging disease. COVID-19 is an example of emerging disease, since it is occurring for the first time.

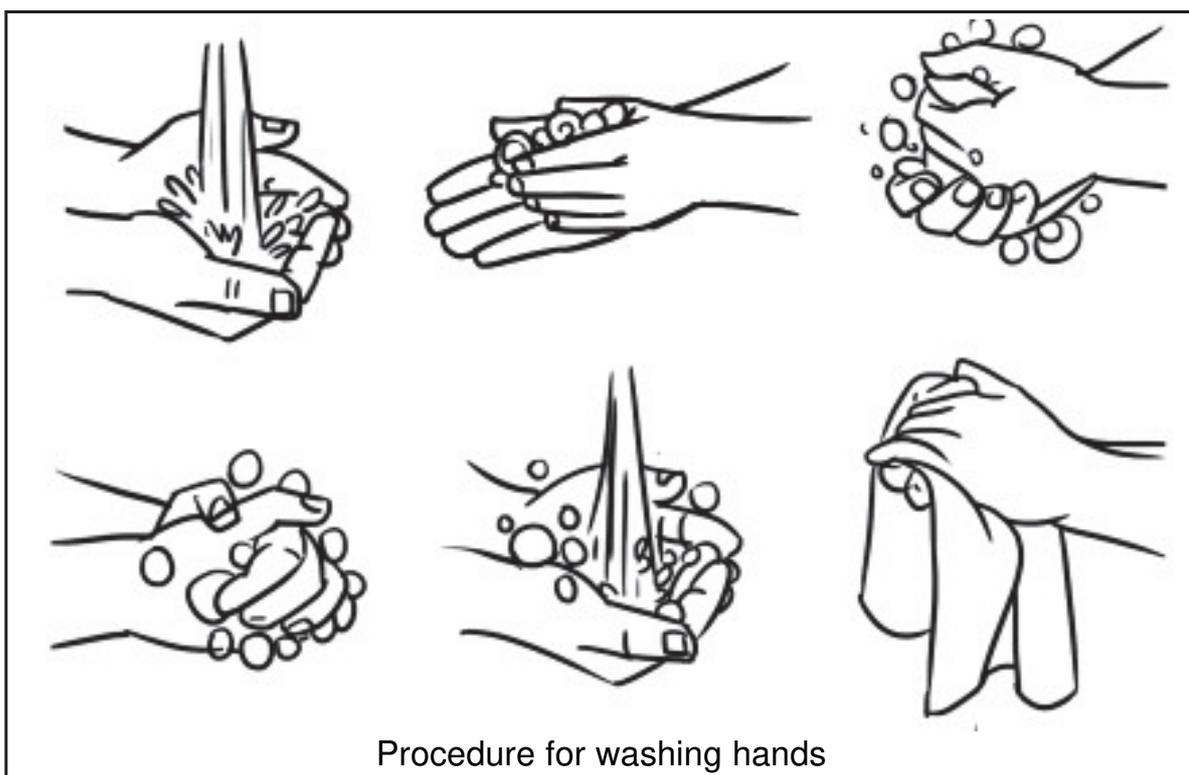
Contagious: Infectious diseases that spread from person to person are said to be Contagious in nature.

Washing hands: Hand washing is one of the best ways to protect oneself and family from getting sick. Washing hands can keep healthy and prevent the spread of respiratory and diarrhoeal infections from one person to the next. Infectious agents can spread from other people or surfaces by: a) Touching eyes, nose, and mouth with unwashed hands, b) Preparing or eating food and drinks with unwashed hands, c) Touching a contaminated surface or objects, and d) Blowing nose, coughing, or sneezing into hands and then touching other people's hands or common objects.

In general, washing hands is warranted; a) Before, during, and after preparing food, b) Before eating food, c) Before and after caring for someone at home who is sick with vomiting or diarrhoea, d) Before and after treating a cut or wound, e) After using the toilet, f) After blowing nose, coughing, or sneezing, f) After touching an animal, animal feed, or animal waste, g) After handling pet food or pet treats, and h) After touching garbage. In addition, during COVID-19 pandemic situation, hands need to be washed after going in a public place and touching an item or surface that may be frequently touched by other people, such as door handles, tables, gas pumps, shopping carts, or electronic cashier registers/screens, etc, and before touching own eyes, nose, or mouth because that's how microorganisms enter into the body.

Follow these FIVE simple steps while washing hands (technical information sourced from Centres for Disease Control and Prevention website);

- i) **Wet** hands with clean, running water (warm or cold), turn off the tap, and apply soap. **Why?** Because hands could become re-contaminated if placed in a basin of standing water that has been contaminated through previous use, clean running water should be used. However, washing with non-potable water when necessary may still improve health. The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly. Turning off the faucet after wetting hands saves water, and there are few data to prove whether significant numbers of germs are transferred between hands and the faucet. Using soap to wash hands is more effective than using water alone because the surfactants in soap lift soil and microbes from skin and people tend to scrub hands more thoroughly when using soap, which further removes germs.
- ii) **Lather** (or foam) hands by rubbing them together with the soap. Lather the backs of hands, between fingers, and under nails. **Why?** Lathering and scrubbing hands creates friction, which helps lift dirt, grease, and microbes from skin. Microbes are present on all surfaces of the hand, often in particularly high concentration under the nails, so the entire hand should be scrubbed.
- iii) **Scrub** (or rub) hands for at least 20 seconds. **Why?** Determining the optimal length of time for hand washing is difficult because few studies about the health impacts of altering hand washing times have been done. Of those that exist, nearly all have measured reductions in overall numbers of microbes, only a small proportion of which can cause illness, and have not measured impacts on health. Solely reducing numbers of microbes on hands is not necessarily linked to better health. The optimal length of time for hand washing is also likely to depend on many factors, including the type and amount of soil on the hands and the setting of the person washing hands. For example, surgeons are likely to come into contact with disease-causing germs and risk spreading serious infections to vulnerable patients, so they may need to wash hands longer than a woman before she prepares her own lunch at home. Nonetheless, evidence suggests that washing



hands for about 15-30 seconds removes more germs from hands than washing for shorter periods. Accordingly, many countries and global organizations have adopted recommendations to wash hands for about 20 seconds.

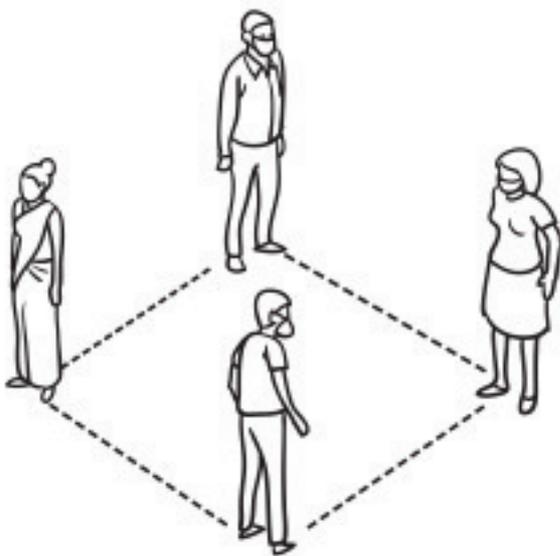
- iv) Rinse** hands well under clean, running water. **Why?** Soap and friction help lift dirt, grease, and microbes—including disease-causing germs—from skin so they can then be rinsed off of hands. Rinsing the soap away also minimizes skin irritation. Because hands could become re-contaminated if rinsed in a basin of standing water that has been contaminated through previous use, clean running water should be used. While some recommendations include using a paper towel to turn off the faucet after hands have been rinsed, this practice leads to increased use of water and paper towels, and there are no studies to show that it improves health.
- v) Dry** hands using a clean towel or air dry them. **Why?** Germs can be transferred more easily to and from wet hands; therefore, hands should be dried after washing. However, the best way to dry hands remains unclear

because few studies about hand drying exist, and the results of these studies conflict. Additionally, most of these studies compare overall concentrations of microbes, not just disease-causing germs, on hands following different hand-drying methods. It has not been shown that removing microbes from hands is linked to better health. Nonetheless, studies suggest that using a clean towel or air drying hands are best.

Isolation or quarantine: Both the terms, isolation and quarantine, though used interchangeably, actually refer to two different processes that depend on whether the person is actively sick or not.

Isolation is a process adopted to separate the infected person from the healthy ones, until they fully recover and are no longer able to spread the disease.

Quarantine is a process used to prevent spread of contagious disease by keeping the exposed persons, who are not yet sick, away from the unexposed ones, under the medical advice of a doctor. It could be both formal, wherein health officials separate individuals from the population and keep them in a special facility, or informal, wherein people are recommended by health care providers to stay at home in 'self-quarantine' to avoid potentially spreading the disease to others. Duration of quarantine depends on the incubation period of the disease, or how long it takes to develop symptoms after coming in contact with the infected person. If individuals develop the symptoms during quarantine, then they are moved to isolation.



Social distancing: Social distancing

is a term applied to the measures taken for prevention and control of the spread of highly contagious disease. Closure of educational institutions, working from home, cancellation of events, and avoidance of large gatherings are some of the actions taken during social distancing.

Immunity: Immunity is commonly understood as disease resistance or ability of the body to defend against all types of foreign bodies; be it microorganisms, toxic substances and the likes. Lack of immunity in an individual is called as susceptibility.

Mainly there are two types of immunity; innate or natural or non-specific, and acquired or adaptive.

Innate or inborn immunity is inherited from the parents and provide protection right from birth throughout life. For example, humans have inherent immunity against a disease called Distemper, which is a fatal disease of dogs. Being nonspecific immunity, it is provided through a number of barriers at the points of entry into our body; these are physical as skin, physiological as acidic pH in stomach, cellular as WBC, and cytokine barriers.

Acquired or adaptive or specific immunity is acquired by an individual after the birth, which is specific and mediated by antibodies or lymphocytes or both. It not only relieves the infected person from the disease but also prevents from attacks in future. Acquired immunity is of two types; active immunity and passive immunity.

In active immunity cells of an individual produces antibodies in response to an infection or vaccination. The process is slow but long lasting and harmless. Again, active immunity is either natural or artificial. Someone who recovers from an attack of small pox develops natural active immunity, while childhood vaccination provides artificial active immunity.

While in passive immunity ready-made antibodies are directly injected to provide protection against the pathogens. It gives immediate response but is not long lasting. This immunity is also of two types; natural and artificial. Natural passive immunity can be induced by transferring antibodies from mother to fetus through placenta, and feeding colostrum, mother's first milk, which protects the infants up to three months of age. Administration of hyper-immune serum like anti-tetanus serum is an example of artificial passive immunity.



Self-medication: Self-medication is a global phenomenon in which an individual or a member of the family select and use medicines to treat self-recognized or self-diagnosed condition or symptom. Weighing pros and cons of self-medication, disadvantages score over the benefits. Potential risks of self-medication include; incorrect self-diagnosis, delay in seeking medical attention, probable adverse drug reactions, incorrect dosage, administration, and choice of therapy, along with irrational use of antimicrobials resulting in development of antimicrobial drug resistance.



Sustainable living for a healthy life

What is one's priority – health or wealth? Someone replied, 'Wealth, till I am healthy, and of course, health, when I'm sick'. Reality strikes when not just an individual but entire humanity suffer. The period of isolation, quarantine or social /physical distancing has allowed almost everyone to redesign their lifestyle. Going back to basics, surviving on the bare necessities, and leaving environment to heal back are the takeaways from the locked down situation.

It is expected that health of all the three components of sustainability must be in pink; the social, economic, and environmental. On social front, the physical (particularly for recovered ones) and mental health should be the priority areas. Psychological duress due to both; traumatic experience of the pandemic period and post-pandemic impact on the livelihood, is likely to take a great toll, unless handled sensitively. Effect on the economic health during or post-pandemic period, would leave a significant mark on lifestyle and livelihood of the future.

For the revival and maintenance of the degraded environment and to uplift the way of living life under changed circumstances, it would be necessary to put in some conscious efforts to change the overall outlook of our lifestyle. It would need dedication and discipline on daily basis to adapt and upgrade the standard of living in sustainable manner.

A second chance, rare of rarest opportunity has been given to the entire mankind, to adopt the changes recommended for sustainable living, in its true spirit. Only then we have a future - a healthy future.