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LEARNING TO COPE WITH THE COVID 19 PANDEMIC

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Introduction

The year 2020 started with the WHO report that in China, there was a rapidly spreading respiratory illness caused by a novel coronavirus, SARS CoV 2. The first two months of the year witnessed the rapid spread of infection across continents and countries and COVID 19 was notified as a pandemic. The challenge posed by COVID 19 evoked a global resolve to ensure that the tragedy of the 1918 flu pandemic is not repeated. Initially, all countries tried to limit the spread of infection by screening and quarantining travellers from affected countries and later banning inward travel from affected countries. This to some extent might have delayed, but did not halt the spread of infection across countries. In the next two months there were reports of spread of infection across provinces and from urban to rural areas in many countries. This prompted almost all countries to impose lockdowns of varying duration and effectiveness. The lockdown did perhaps slow down the spread of infection by a few days or weeks. Countries utilised this time to reorganise and prepare the health system to cope with the anticipated increase in infections. Simultaneously efforts were made to generate awareness among the population on universal precautions that should be taken to reduce the risk of infection and how to seek health care if they fall ill. Prioritisation of care for COVID 19 patients, led to reduction in access to health care for persons with other illnesses and coverage under the national MCH and disease control programmes. Lockdowns also brought in their wake substantial collateral damage, economic slowdown, fall in industrial production, rising unemployment, poverty and food insecurity especially among the poor and vulnerable segments of population.

Research studies of unprecedented magnitude are under way to document modes of transmission and natural history of the infection; these data are essential for designing medium and long terms strategies to contain and control the epidemic. Currently RT PCR is widely used for detection of SARS CoV2 infection. Simpler point-of-care antigen tests for diagnosis of SARS CoV 2 infections and serological tests to monitor trends in infections and impact of interventions have been developed and tested. Clinical trials evaluating the safety and efficacy of drugs for treatment of severe cases and vaccines for preventing SARS Co V 2 infection in high risk persons are being fast tracked.

Six months after recognition of the pandemic, there are over thirteen million confirmed cases. But the health system interventions have succeeded in keeping death rates due to the COVID 19 pandemic relatively low. There is a growing realisation that for the foreseeable future, the world has to learn to live with the virus by taking universal precautions to reduce the spread of infection, providing care for those who are infected and minimising the adverse consequences of COVID 19 pandemic on the delivery of other health services. Even though the epidemic is still on the upward swing, efforts are under way to bring about phased unlocking to halt and later reverse the adverse economic fallout of lock down. The changing scenario of the COVID pandemic and the response to these changes especially in the last three months are reviewed in this article.

Magnitude of the pandemic: Global

COVID 19 has spread across all the continents of the world. WHO collates COVID 19 data reported by all countries and reports them. Using country reports, a large number of global and national COVID trackers provide daily updates on number of persons tested, number of confirmed positive persons, number recovered and number of deaths**.** On 23.7.2020 there were 15,375,005 confirmed cases, and 630,222 have died; there were 5,395,363 active cases and 9,349,420 persons have recovered.

Assessing the burden of COVID-19 on the basis of collated country reports may not provide accurate information. Many countries may not have updated their data fully. India, USA, Brazil and Russia have reported a surge of cases in the last two months. China reported the largest number of confirmed global cases till February, but subsequently reported very few new cases. Efforts have to be redoubled to ensure accurate and timely reporting of all cases by all countries.

Fig 1 Confirmed cases in different countries

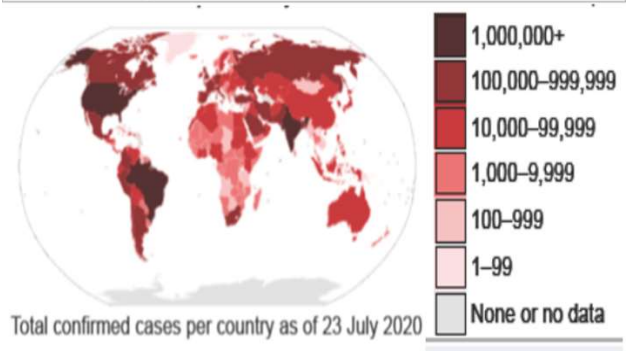
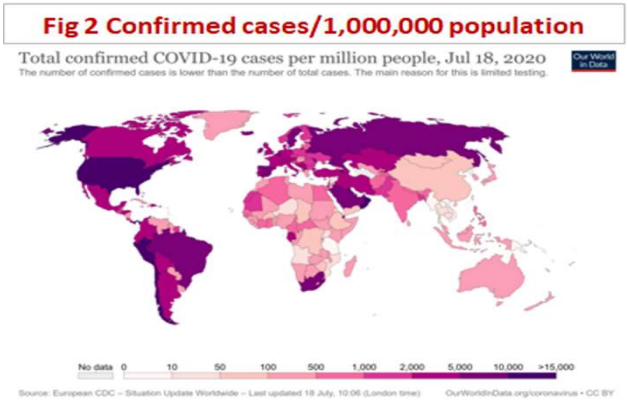


Fig 2 Confirmed cases/1,000,000 population

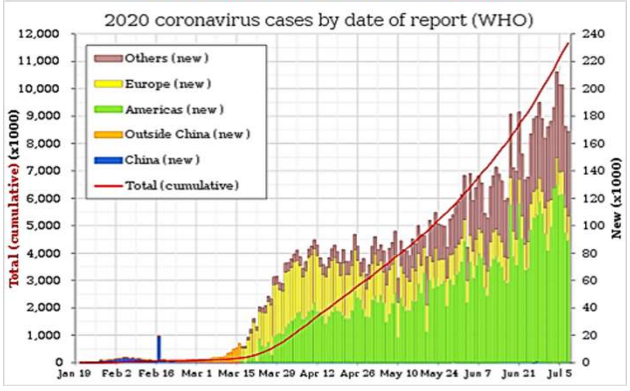


One of the major factors that influences the number of cases in any country is the size of its population. Fig 1 is the global map colour coded on the basis of number of confirmed positive persons reported by the country. Fig 2 is the global map colour coded on the basis of number of confirmed positive persons reported by the country per 100,000 population. India which reported the third largest number of confirmed cases, has relatively low infection rates per 100,000 population. Testing strategies vary between countries and within countries over time. Most countries initially tested persons seeking health care for respiratory problems and persons travelling from COVID 19 affected countries; later focus shifted to contact tracing of those tested positive and testing of household and other contacts. Many countries now follow WHO recommendation "test, identify, treat, trace contacts and test" strategy. Over time many countries including India have shown an increasing percentage of persons testing positive among those screened. When larger number of people are tested there will be larger number of confirmed cases even if there is no rise in positivity rate. Studies to assess the impact of all these factors on confirmed cases are under way and may provide useful leads in understanding the variations.

Time trends in COVID 19 pandemic

The epidemic curve of confirmed COVID cases reported in selected regions is given Fig 3. The United States of America have reported the largest number of cases in the last three months. In South-East Asia, which had relatively low number of confirmed cases earlier, there had been a substantial rise in the last two months mainly because India is reporting large numbers of confirmed cases. Geographic distribution of 14 day cumulative number of reported COVID 19 cases/100,000 population on 23.07.2020 of July showed that South and North America are the worst affected regions in this period (Fig 4). SE Asia may soon join these as one of the highly affected regions.

Fig 3 Epidemic curve in selected regions



Time trends in confirmed cases/100,000 population in selected countries is shown in Fig 5. By far the sharpest rise in confirmed cases was reported in Chile in May 2020. USA and Sweden reported continued rise in cases. In May 2020 number of confirmed cases had plateaued in Spain, Italy and Germany. Canada and UK reported a small rise in the number of cases /100,000. These data suggest that while the epidemic curve appears be flattening in Western Europe, USA, South America and South East Asia report a sharp increase in number of cases. These variations might partly be due to differences in time when the epidemic began in countries and partly due to the effectiveness of the interventions taken to reduce the spread of infection.

COVID 19 in India

India ranks third after USA and Brazil as the country reporting largest number of confirmed COVID 19 cases in the world (Table 1). On July 16th India crossed the one million mark (1,004,654) of confirmed COVID 19 cases. The journey to the first million took 137 days; the first quarter million cases came 98 days after the first case was reported, the second 19 days later, the third after 12 days and the fourth after eight days. The case doubling time is 20.6 days and the country can be expected to reach the second

Fig 4 Geographic distribution of 14 day cumulative confirmed cases/100,000 population

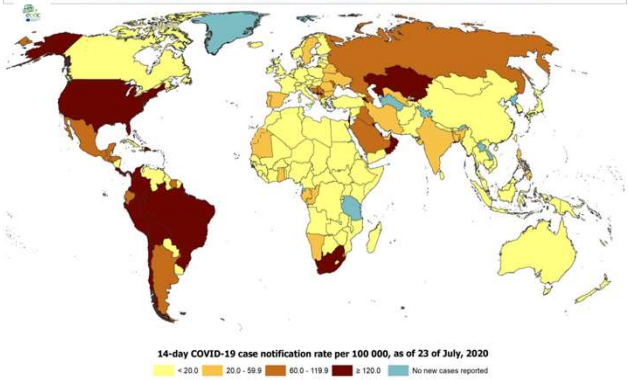


Table 1 Number of confirmed cases in top six countries				
Location	Confirmed cases		Recovered	Deaths
	Total	Active		
World	1,53,75,005	53,95,363	93,49,420	6,30,222
USA	41,00,875	20,12,055	19,42,637	1,46,183
Brazil	22,31,871	6,16,843	15,32,138	82,890
India	11,18,043	3,90,459	7,00,087	27,497
Russia	7,89,190	2,04,392	5,72,053	12,745
S Africa	3,94,948	1,59,833	2,29,175	5,940
Peru	3,26,326	10,156	2,42,474	11,870

million mark in the next three weeks. However the number of confirmed cases/1,000,000 population in India is substantially lower as compared to many other countries (Fig 2). There had been 25,594 deaths; case fatality rates was 2.8%. Case fatality rates in India are lower as compared to rates in the world (4.8%), USA (3.9%) and Brazil (3.8%).

All states in India except Lakshadweep have reported confirmed COVID 19 cases. At the national level 34.2% of cases are active. Maharashtra (112,999) Tamil Nadu (47,343), Karnataka (27,859), Delhi (17,807) Andhra (16,621) are the top five states in terms of active cases. Five cities in India, Thane (34,721), Hyderabad (28,783) Pune (25,510), Mumbai (22,888) Delhi (17,807) account for half the active cases in the country. This scenario is expected to change over the next month when the infection spreads across states and to smaller cities, towns and rural areas. They are expected to contribute substantial proportion of the second million confirmed cases.

Recovery rates [Total confirmed cases minus (recovered cases+ deaths)] from COVID 19 in India has been progressively improving over time. On 10 June, India's recovery rate was 49% of total infections; in early July the recovery rate crossed 60%. Currently nearly two-third of the confirmed cases in India have recovered. Delhi has the lowest (15.2%) and Hyderabad has the highest percentage of active cases (98.4%).These data suggest that the pandemic is in different phases in different cities. Experience from other countries and cities (eg New York in USA)

Fig 6 Confirmed COVID 19 deaths/million population

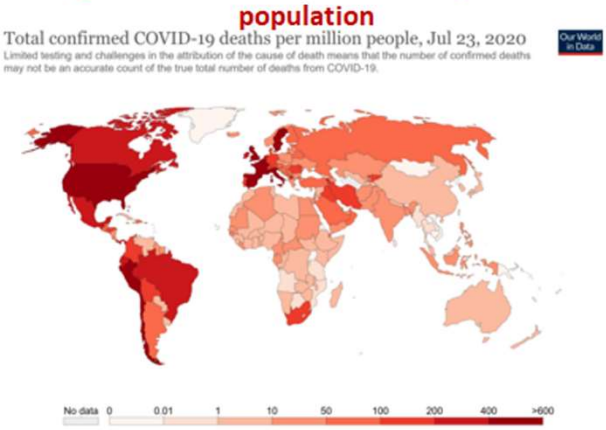
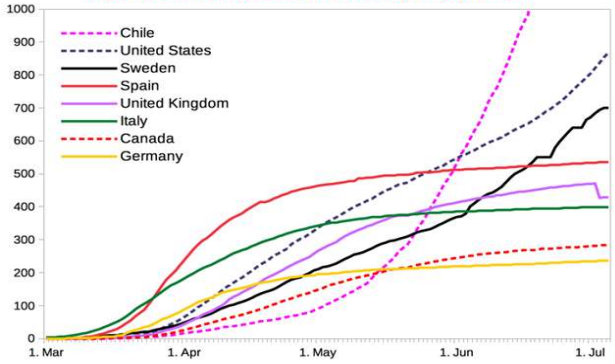


Fig 5 Time trends in confirmed cases/100,000 population

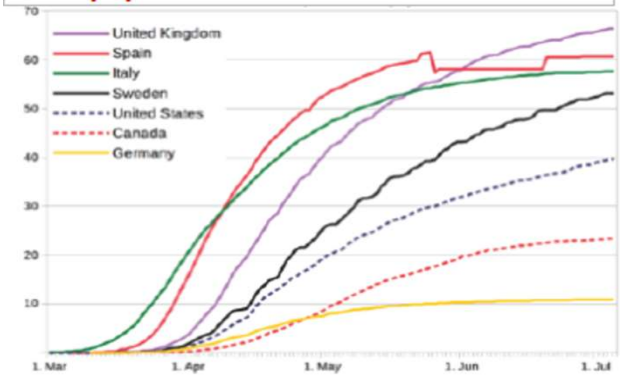


suggest that the infection rates in Delhi and Mumbai may have reached or are near the peak, while infection rates in other cities are on the upswing. Despite high recovery rates, the number of active cases continue to increase, partly because of the large number of persons being tested and partly due to rising positivity rates among those who are being screened in some states.

Mortality rates in COVID 19

Initially China reported high case fatality rates perhaps because only those who were admitted in the hospital with severe respiratory distress were tested and many of these persons had co-morbidities. When COVID was declared as the pandemic there was speculation whether COVID pandemic will match or surpass the 1918-19 Spanish flu, both in terms of % of infected persons (50% of global population) and number of deaths (>50 million). Subsequent months have shown that the death rate associated with COVID 19 infection was relatively low even when compared to SARS pandemic. Globally the average death rate among confirmed cases has been less than 5% (Table 1). Reported case fatality rates (deaths among confirmed cases/total confirmed cases) vary widely between continents (Fig 6) and countries (Fig 7). Case fatality rates are far lower in some developing countries such as India with lower availability of health care infrastructure as compared to USA and UK with better availability of health care infrastructure and aware population accessing existing health facilities. There had been

Fig 7 Confirmed COVID deaths/100,000 population in selected countries



speculations regarding contribution of younger age of the person, prior BCG vaccination, use of hydroxychloroquine, use of nasal oxygen instead of positive pressure ventilation but so far none of these have been proved to be a factor responsible for lower death rates.

To accurately calculate case fatality rates it is important to have correct information on the numerator (number of deaths) and the denominator (number of COVID 19 infected persons). There are problems with reported data both regarding denominators and numerators. The available information on the deaths (numerator) have not been analysed regarding profile of the person, risk factors, how and when they accessed health care and treatment details. A positive test for corona virus does not mean necessarily that this virus was primarily responsible for a patient's demise. Deaths have not yet been classified into those due to COVID and COVID positive persons who died of other causes (eg cerebrovascular accidents, myocardial infarction). Differences in the time of seeking health care, adequacy and appropriateness of health care could also be some of factors for the reported differences in death rates.

Currently there are no dependable estimates of the denominator - ie number of infected persons. Computed COVID positivity rates do not give any idea about who all were tested, which tests were used. Even in the countries with extensive testing such as USA, CDC has estimated that the number of persons infected with COVID are ten times the number of confirmed COVID cases. In India estimated prevalence of COVID 19 in patients with severe acute respiratory infection (SARI) was 1.8 %; recent sero-surveillance for COVID 19 in Delhi reported that about 22.9% of the over 21,000 samples tested were positive. There will be huge differences in computed case fatality rates depending upon which was the denominator used: confirmed positive cases or number of infected persons estimated from IgG ELISA based sero-surveillance. One of the major advantages that epidemiologists have in the COVID 19 pandemic is the global data base on an unprecedented scale reported by all countries. In the present 24X7 current COVID 19 news mode, the focus of reporting is only total number of confirmed cases, recovered cases and deaths. Over the next few months in-depth analysis of all the data pertaining to the profile of the population screened and those found positive, course and outcome of those who tested positive and management protocols followed in severe cases in different hospitals can be done. These analyses will provide invaluable leads for mid-course modifications of intervention to contain and control the COVID pandemic. Some of the major factors that might be responsible for the reported wide variations in cases and deaths between countries are discussed in the following pages.

Testing for SARS Cov2 infection

In the initial stages of the pandemic it was of utmost importance to diagnose SARS Cov2 infection as early after exposure as possible; the infected persons could then be monitored and provided necessary care to minimise the adverse health consequences. Simultaneously the infected person's family and other contacts could be isolated to limit the spread of infection. Therefore tests for detection of viral presence were developed and used for screening. The likelihood of detecting the virus depends on collection method and how much time has passed since infection. Nasopharyngeal swab is the preferred sample; however it is difficult to collect nasopharyngeal swab; throat swabs can also be used. In persons with severe infections admitted after 10 days of exposure, throat swabs may not pick up adequate viral material. In such cases sputum and deep airway material collected via suction catheter can also be used**.**

Diagnosis of SARS CoV 2 infection in individuals are made by the detection of viral presence. Reverse transcription polymerase chain reaction (RT-PCR) has been recognised as the gold standard test for detection of SARS CoV-2 infection because it has high sensitivity and specificity. Initially the tests were conducted in virology labs in research institutions and super-speciality hospitals; these had all the necessary equipment and well trained personnel with previous experience in conducting these types of tests. In an effort to ramp up testing capacity all countries rapidly trained personnel and provided the needed equipment to labs, checked their performance and recognised newer labs for testing. In India currently ICMR has approved a total of 1000 COVID-19 testing labs in both public (730) and private sector (270) to carry out tests for diagnosis of SARS CoV 2 infection. Every effort is being made monitor labs and ensure quality of the tests conducted. Labs with suboptimal performance were not allowed to continue testing. In hospital settings especially while testing symptomatic persons and those with co-morbidities, RTPCR is used for detection of infection

Use of RT-PCR test for screening has two major problems:

- RTPCR equipment is not available in smaller hospital either in government or private sectors;
- it takes 5-6 hours to process samples and results are usually reported after one or two days.

Rapid Point-of-Care (PoC) Antigen Detection tests which do not require elaborate equipment and can be done at district hospitals and similar centres have been developed; with these tests results can be provided within an hour or two. ICMR and AIIMS, Delhi independently evaluated the stand-alone rapid PoC antigen detection assay. Antigen tests have relatively low sensitivity (do not detect all infected persons) but high specificity (all persons testing positive are infected). There is no need to confirm by RT-PCR in those who have been detected to be positive. But some of those who were negative by antigen test may be infected (false negatives) and so all those who test negative have to be tested again with RT-PCR five days later. It is imperative that all programme officers, health personnel and the tested persons are informed that all those who tested negative by Rapid Antigen test have to be re-tested using RT-PCR. If this step is not meticulously followed, a substantial

proportion of COVID positive persons will be missed. They may go away with a false sense of security that they had tested negative, will not isolate themselves, and expose their family and contacts to infection. Since the person tested negative the health staff may not isolate the person and initiate screening of the family; tracing and testing of contacts will not be done. If antigen testing is used for screening persons in hospital settings it may not be possible to follow up all negative persons and retest them. Some of those who were infected will be missed and not receive the treatment. It is therefore essential that ICMR guidelines that the antigen test should be used for large scale community-based testing in high case load containment zones and all those who test negative should be retested after five days by RT-PCR test should be meticulously followed.

So far only RT-PCR was used for testing and so reporting was relatively simple. If states report both RT-PCR and Antigen test positives together, there may be a reduction in the number tested positive because of the false negatives associated with antigen test. The reduction in number of new confirmed cases might be misinterpreted as decline after the epidemic peak has started.

Till now all countries were reporting only RT-PCR positive persons as confirmed positive persons. Once antigen tests come into routine practice, all countries have to modify their reporting format to separately report:

- RT-PCR positive cases,
- antigen test positive cases,
- antigen test negative cases who were retested with RT-PCR and found positive;
- antigen test negative cases who were retested with RT-PCR and negative; and
- antigen test negative but could not be followed up and tested with RTPCR.

In future, all in depth analyses of epidemiology of COVID infection have to take into account the type of test used for diagnosis as yet another factor which could be responsible for the reported differences between countries and differences in the same country during different time periods.

Course and outcome of SARS CoV 2 infection

In the last three months all countries have documented the course and outcome of SARS CoV 2 infection. All infected persons are asymptomatic immediately after infection. The period between infection and the appearance of symptoms (incubation period or pre-symptomatic period) for COVID-19 is around five days (range 1-14 days). During this period persons can transmit the infection. Many infected persons remain asymptomatic (reported range 5-30%); asymptomatic persons can unknowingly transmit the infection. In order to reduce the chances of the spread of infection from pre-symptomatic and asymptomatic infected persons, physical distancing, mask wearing and hand washing are advocated as universal precautions to be followed by all the citizens.

Illness caused by SARS CoV-2 infection is usually mild, especially in children and young healthy adults. About 85% of infected symptomatic persons develop, runny nose, cough, fever, fatigue and body ache. All symptomatic persons have to be assessed regarding clinical presentation, potential risk factors for severe disease, capacity for isolation at home and availability of persons to provide home-based supportive care. In India, Kerala where the infection was first detected, all persons who were tested positive and all those with mild infection were kept in home isolation. The family was also kept in home isolation for 14 days. The state government ensured that all the necessary provisions were delivered at their door steps. As the family was at home, there were no problems in providing home-based care for the infected persons. The infected person lived at home, had home food and the comfort of being cared for by the family. The health system did not have to cope with strain of looking after worried infected persons who did not require hospitalisation. The health service personnel contacted the infected person daily mostly through mobile phones. Mildly symptomatic persons were given symptomatic treatment (paracetamol for fever, aches and pains, anti-histamines for runny nose and cough syrups for cough); majority of positive persons responded readily and recovered within a week or 10 days. All positive persons and their family were provided with a help line number to call if they had any queries or problems. If the positive person developed high fever or breathlessness, the health services reached home and admitted the person in the hospital and provided the needed care. All elderly persons and persons with co-morbidities were monitored closely especially in the second week after onset of symptoms; if there was any deterioration in health status they were admitted to hospital. After reviewing the feasibility and safety of the model of care provided by Kerala, Government of India has reiterated the earlier guidelines recommending the adoption of this model. Currently almost all countries favour home-based care for mildly symptomatic persons, if home care is possible.

Infected persons (both symptomatic and asymptomatic) transmit the virus readily to others - especially when they cough or sneeze or talk (droplet infection), dry their nose and touch surfaces (surface contamination). To minimise the risk of spread of infection, all infected persons should to wear a mask, observe respiratory etiquette, wash their hand as and when they touch their face, nose or mouth. Family members who provide care should wear a mask, stay about a metre from the infected person, wash hands with soap and water as and when they touch the surfaces touched by the infected person.

Management persons with moderate infection

About 10-15% of those infected with COVID 19 develop moderate infection and require hospitalisation and treatment; about 5% develop severe infection and require intensive care. Severe infections are more often seen in elderly especially in those with respiratory problems, diabetes or hypertension.

Management of moderate infection is mainly supportive and symptomatic. There have been case reports of some improvement in severity and reduction in duration of hospitalisation in persons treated with anti-influenza drugs or anti-HIV drugs on an empirical basis. Hydroxychloroquine has been used empirically as a nonspecific drug in treatment of moderate COVID 19 infection in some countries. But recent global trials have not shown any impact on infection; WHO does not recommend its use either as a prophylactic or for treatment of COVID 19. After full review of all the available data, WHO and CDC guidelines state that at present there are no proven antiviral drugs for treatment of COVID 19 infection. WHO guidelines state that antibiotic use is indicated only in those with bacterial pneumonia but review of hospital data showed that about ¾th of the severely ill patients received antibiotics. Majority of patients received supportive measures including nasal oxygen and antipyretics. It is estimated that over 90% of persons with moderate illness who did not have any co-morbidities, recovered within a fortnight. Globally trials with antiviral agents for treatment of COVID 19 are being fast tracked and effective drugs for treatment of moderate and severe COVID 19 infection may become available in the next few months.

Management persons with severe infection

Majority of the patients with severe infections present with hypoxia and adult respiratory distress. The underlying pathology causing respiratory distress varies. Diagnosis of the underlying pathology leading to respiratory distress may be difficult even in super-speciality hospitals with all the needed equipment and experienced experts. Effective management revolves around the supportive management of pneumonia, hypoxemic respiratory failure/ARDS. Viral pneumonia and secondary bacterial pneumonia are common and may not pose major difficulties in diagnosis. Several anti-viral drugs used for treatment of influenza or HIV are empirically used for treatment of viral pneumonia. Appropriate antibiotics help in management of secondary bacterial pneumonia. Initially almost all COVID 19 patients with hypoxia were put on ventilators and given positive pressure ventilation. Some recent reports suggest that positive pressure ventilation may aggravate rather than alleviate hypoxia in some patients, for example, those experiencing an inflammatory cytokine storm. Currently, most COVID patients with low oxygen saturation are managed with O_2 through nasal catheter and nursing the person in the prone position to improve lung expansion. There had been several reports of beneficial effect of convalescent plasma infusion on severity and duration of severe COVID 19 infection. Some states like Delhi have set up convalescent plasma banks. Currently there are ongoing clinical trials to assess safety and efficacy of convalescent plasma in COVID 19 infection and the results are expected to available in the next few months.

Some patients with COVID 19 may be at increased risk for venous and arterial thrombosis of large and small vessels. This may affect the pulmonary vessels in some but manifestation can also be that of disseminated intravascular coagulation and multi-organ failure. The pathogenesis for COVID 19 associated hypercoagulability is not fully understood; it is hypothesised that hypoxia and systemic inflammation secondary to COVID 19 may lead to high levels of inflammatory cytokines and activation of the coagulation pathway. Such patients may benefit from administration of dexamethasone.

Apart from respiratory problems, severely ill COVID 19 patients may suffer from septic shock, cardiomyopathy and arrhythmia and acute kidney damage. Prolonged hospitalisation in COVID 19 patients with co-morbidities can at times lead to development of deep vein thrombosis and pulmonary embolism. Such patients can benefit from use of anticoagulants like heparin.

Clearly clinical treatment severe COVID 19 is continually evolving and is expected to improve survival rates. All national and international agencies are continuously reviewing all the available data and modifying the guidelines for management both regarding diagnostic criteria and appropriate drug(s) for management. But smaller hospitals which may in future get large number of cases when the infection spreads widely in rural areas will face difficulty in diagnosing which of the factors listed above is responsible for the severe symptoms and providing appropriate medication.

Despite wearing Personal Protection Equipment while providing care for the hospital patients, COVID 19 infection does occur in health personnel; almost all infected persons have recovered but there had been deaths reported from all countries. In India some of the recovered health care providers had volunteered to donate convalescent plasma; other had volunteered to work in wards with COVID 19 patients because they could take care of COVID 19 patients during hot monsoon season without cumbersome PPE. The news of these actions have overnight made the stigmatised COVID 19 positive persons into highly appreciated COVID warriors.

Documentation of epidemiology COVID 19 infection

Documentation of natural history and epidemiology of the infections is essential for evolving intervention programmes for controlling infections and monitoring its impact. For these purposes we need the following information In COVID 19 infection:

- What proportion of exposed persons develop infection?
- What is the incubation period?
- How is the infection transmitted
- At what stage of illness does infection gets transmitted?
- What % of exposed person develop infection?
- At any given place and time what % of the population is infected?
- What % of all infected person develop symptoms?
- What % develop mild, moderate and severe infections?
- What is the case fatality rates in COVID 19 infection? and

- How many of the deaths in COVID positive persons are due to co-morbidities?

Careful analysis of available massive global data base running into several millions will provide important leads to answer these questions. However carefully followed up complete data sets of even small number of persons can provide vital information.

COVID infection in "Diamond Princess"

A small but complete data set of the number of persons exposed to infection, number who got infected and number who died were available from the people who were quarantined in the cruise ship Diamond Princess. At the end of one month cruise in this closed environment in contact with persons with COVID 19 infection, about a third of the exposed persons were infected; there were seven deaths among the 700 infected persons suggesting that the death rate was about 1% in the predominantly elderly exposed population. Using mortality rates from this very small but complete data set, US CDC estimated that in the US population fatality rate among the symptomatic cases is likely to be 0.4 %; as about third of all infected persons are asymptomatic and the estimated overall infection fatality rate (IFR) is 0.26%. The computed mortality rates for infected persons could undergo a further tenfold reduction if we use the CDC estimation that for every confirmed case of SARS CoV2 infection, there are ten undetected cases.

Estimating prior infection using IgG antibody testing

Information on number and proportion of person who had so far had SARS CoV 2 infection is essential for assessing the disease burden due to COVID 19 in specific areas, states, countries and regions of the world. Currently numerous IgG and/or IgM antibody tests assays using enzyme linked immunosorbent assays (ELISAs), lateral flow immunoassays (LFIAs), and chemiluminescent immunoassays (CLIAs) are available. In view of the high specificity of these tests, high quality antibody tests in population using appropriate sampling frame can be used for assessing the magnitude of seropositive (previously infected population). Repeated sentinel sero-surveys measuring IgG antibodies to SARS-CoV-2 in carefully selected populations can provide reasonably reliable estimates of time trends in sero-positivity and can be used for monitoring the progression of the epidemic and assessing the impact of various interventions to reduce transmission rates.

A small-scale sero-prevalence study was undertaken in Geneva between April 6 and May 9, 2020, on 2766 participants from 1339 households, with a demographic distribution similar to that of the canton of Geneva. The estimated sero-prevalence increased from 4.8% (95% CI 2.4-8.0, n=341) in the first week to 10.8% (8.2-13.9, n=775) in the fifth week. Individuals aged 5-9 years (relative risk [RR] 0.32 [95% CI 0.11-0.63]) and those older than 65 years (RR 0.50 [0.28-0.78]) had a significantly lower risk of being seropositive than those aged 20-49 years, perhaps because these two age groups tended to be at home most of the time. It was estimated that for every reported confirmed case, there were 11.6 infections in the community.

Based on data from ongoing sero-surveillance of COVID 19 in US, CDC estimated that 20 million Americans (6% of the nation's 331 million people) have been infected with the corona virus since it first arrived in USA. The US has reported 2.3 million confirmed cases; for every confirmed COVID 19 positive case that was reported, there would be 10 more undetected ones, a majority of whom may not know that they had been infected. As only 6% of the US population is seropositive the vast majority of the population remains susceptible and may get infected in future.

In February 2020 ICMR initiated sentinel surveillance for COVID 19 in 16 sites collecting both nasopharyngeal swabs for RT-PCR (for current infection) and blood samples for IgG antibodies (for past infection) testing for SARS CoV-2. In May 2020, ICMR initiated a sero-surveillance programme of testing 30,000 people from the general population in collaboration with the State governments. Initial results showed considerable inter-state variation in sero-positivity rate (ranging from less than 1% to nearly 10%). Subsequent rounds are expected to provide useful information on time trends in past infection with COVID 19 in urban and rural areas in different states and help to plan appropriate health and other sector activities as we all learn to live with COVID 19.

National Centre for Disease Control (NCDC) had conducted a serological survey between 27.6.2020 and 10.7.2020 in a representative sample of about 21,387persons living in different parts of Delhi. Samples were tested for IgG antibodies to SARS CoV2 and 22.9% were seropositive (range between districts 12.9% and 27.9). If the overall infection fatality rates in Delhi are computed taking 23% of Delhi population as infected, the case fatality rates are only 0.1per thousand. As many more countries are currently undertaking IgG antibody surveys, it will be possible to get comparable data.

All the reported data on sero-prevalence suggest that at the time of the survey in most communities about 10-25% of the population had prior infection with SARS CoV-2 infection. Computed confirmed cases are between 0.7 to 1.5% of the population. It is obvious that even in countries with high COVID 19 testing rates, only about one in ten of the infected persons have been tested and found to be COIVD 19 positive. The rest are untested and unaware that they are infected; however they are capable of spreading the infection. This is the most important reason why all persons at all times should follow universal precautions to reduce the risk of infection: going out of home only when necessary, avoiding crowded places, keeping physical distance of at least one meter and wearing multi-layered cloth mask; washing hands with soap and water if surfaces handled by many persons had been touched.

Health services during COVID 19 epidemic

India's health system was unevenly distributed and over-burdened even prior to COVID 19 pandemic. The country desperately needed time to reorganise to cope with the additional task of providing health services related to COVID 19 infection and informing the population about health care during the COVID 19 pandemic. The lockdown did provide a period of three to four weeks for reorganising the health system. Health care institutions have been re-designated and redeployed to cope with rising number of COVID 19 cases; they have provided the needed care and succeeded in keeping the mortality in COVID 19 cases low. But these steps imposed severe limitations in terms of providing health care to persons seeking health services for other conditions. Inevitably emphasis on COVID 19 care has led to a decline in persons receiving preventive, promotive and curative services, services under the national disease control programmes and maternal and child health care. Elective surgeries and procedures have been deferred. These can result in rising morbidity and mortality rates due to non COVID 19 related health problems in the coming months.It is increasingly recognised that the COVID 19 pandemic will continue for several months and the health system has to now gear up to deliver services not only services related to COVID 19, but also restore the services which were being provided under maternal and child health and disease control programmes. Hospitals have to work hard, clear the backlog of cases in whom treatment was deferred during the last four months and provide all the needed services for patients in the coming months.

Impact of COVID 19 epidemic and lock down on other sectors

Almost all countries had implemented lockdowns of various durations, severity and levels of compliance as the key intervention to slow down the COVID 19 pandemic. Almost all sectors of human activity were adversely affected and suffered collateral damage due to effectively implemented, sudden, prolonged and severe lockdown. As the lockdown occurred during the exam period, educational institutions and students suffered. There were attempts to reduce the adverse consequences of shutting down of educational institutions by increasing e-learning but outreach of these efforts was limited. Even prior to January 2020, India was facing an economic downturn. Lockdowns resulted in shutting down of industrial activity, aggravating the economic slowdown, with a sharp rise in unemployment and an adverse impact on human capital. The Government has unveiled economic incentives to industries especially micro, small and medium industries which employ a large work force but it might take a while for activities to restart especially because the skilled labour may not be available and demand is low.

A humanitarian crisis unfolded when unemployed urban migrant workers tried to get back home during the lockdown period. Many states provided 35kg free food grains to all; all needy persons were provided cooked food twice a day. These did alleviate hunger in those who could access them; but the outreach of these services were not universal. As soon as Unlock 1 was operationalized, priority was accorded to sending the migrants back home by operating special trains. This mass movement of millions of people who were living in crowded urban areas with high COVID 19 case load to rural areas might result in more rapid spread of infection in rural areas. When migrants returned they faced quarantine in their home states. Unemployment levels among migrants who returned home was reported to be high. The Government had expanded rural employment programmes and continued the free food grain till end of November 2020supply to mitigate food insecurity.

The way forward

Globally and in India the pandemic curve continues to rise; all countries are trying to learn to live with the virus for the immediately foreseeable future. Having realised that continued lock down will no longer reduce spread of COVID 19, a rational phased unlocking has been initiated. Economic stimulus packages are being provided, to stimulate the stalled economic activities, halt and later reverse the economic slowdown, fall in industrial production, rising unemployment, poverty and food insecurity.

There is a growing awareness in all counties that there are ten or more undetected cases for every detected COVID 19 case. In all countries the key strategy is to screen and detect all SARS CoV-2 infected persons using appropriate tests. Mild cases can be provided home care and followed up. Hospitalisation and appropriate treatment provided to moderate and severely ill persons and high risk cases will avert deaths. Drugs to treat SARS CoV2 will become available in the next few months and will improve survival rates in those with severe infection. Convalescent plasma infusion may help in reducing the severity and duration of illness. Vaccines to prevent infection in high risk persons may become available in about 12 months and help in bringing about further reduction in deaths due to COVID 19. Intense campaign through all media of communication need be continued to ensure that all people, at all times diligently follow precautions to minimise spread of COVID 19 infection. The sustained implementation of these may result in some reduction in all types of respiratory infections. Over time, COVID 19 care will become integrated into the national communicable disease control programmes.

In the coming months health systems will have to evolve a sustainable strategy to provide needed care for COVID 19 cases while continuing to implement MCH and disease control programmes and providing needed care to persons with other illnesses. The health system strengthened during COVID pandemic may then be able to gear itself up to deliver equitable preventive, promotive and curative care for all and propel the country towards SDG targets.

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