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Why & Where We Failed to Control Swine Flu?

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Abstract: ***In an overpopulated, economically challenged country like India any infectious disease spreads fast. The swine flu virus demonstrates requisite characteristics of a pandemic strain-spread by droplet infection, has virulence and humans are immunologically naive to it and it shows possible mechanisms for antigenic shift and reassortment. In present era infectious diseases are becoming more complicated by global challenges like climate change, global warming, air pollution, increasing population and urbanization, and flawed land use. Vacant posts of health workers, poor*** *surveillance about the seasonal diseases, poor Information Education and Communication (IEC), inadequate diagnostic facilities and low acceptance for vaccination further worsened our situation.* ***We need strengthening surveillance, rapid response to occasion by revamping health infrastructure, empowered by qualified workforce with extension of diagnostic facilities and IEC activities and involve particularly mass media and community. Besides this we need to involve private sector, emphasize rational use of the antiviral agent and need vaccination policy on influenza. Last but not the least there must be sustainable international collaboration for prevention and control of emerging infectious disease like swine flu and measures to mitigate climate change by eco friendly policies as climate change may have role in emerging infectious diseases.***

Keywords: swine flu, pandemic strain, reassortment, surveillance, Seasonal flu vaccination

The world is facing Swine flu as one of the deadliest infectious disease in the past decade which is occurring as pandemic or epidemic.[1,2] It is a major global health burden and has been frustrating the health authorities worldwide to prevent its spread, especially from human to human. In response to it the World Health Organization (WHO) declared the swine flu a pandemic in 2009. The name Swine flu was given as the virus was first isolated in pigs (swine) in 1930 in the United States of America (USA). The swine flu pandemic of 2009 got originated in Mexico. [1-4]

Swine flu is a respiratory disease caused by influenza virus, the infected cases show the symptoms like fever, sore throat, cough, increased nasal secretions, and listlessness [1-4]. The reservoirs of the virus are pigs. The causative virus of the swine influenza is the Influenza A belonging to one of the five subtypes namely: H1N1, H1N2, H2N3, H3N1, and H3N2 and out of these five subtypes, the H1N1 Influenza A strain has been isolated in the infected humans and the rest four subtypes were only exclusive in pigs . [4] The H1N1 virus possess two antigens: H1 (Hemagglutinin type 1) and N1 (Neuraminidase type 1) and it is an enveloped RNA virus of the family orthomyxoviridae. [1-4]

India is also facing the worst swine flu outbreak. The report, 'Seasonal influenza (H1N1) - State/UT-wise, year-wise number of cases and deaths from 2010 to 2017 states that more than one lakh people were infected by H1N1 in the past seven years. In the year 2017 there were 38810 affected cases and 2264 deaths.

According to the data, the worst hit remained Maharashtra with maximum deaths (23,812 cases, 716 deaths) followed by Gujarat (18,206 cases, 431 deaths) and Rajasthan (13,158 cases, 235 deaths).

However, what is most striking is that the over-all number of cases has witnessed a more than 20-fold rise in 2017 as compared to the previous year. There were just 1786 cases across the country in 2016.

The report shows that only Sikkim and Lakshadweep are the two areas that have remained untouched by H1N1 cases in the past seven years. In 2017, four states and a UT - Meghalaya, Mizoram, Nagaland, Sikkim and Lakshwadeep - have not seen even a single case of H1N1 so far. [5]

Annexure-I

Seasonal Influenza (H1N1)– State/UT- wise, Year- wise number of cases and death from 2011 to 2018 (till 14th January, 2018)

S. No.	*States/UTs*	*2011*		*2012*		*2013*		*2014*		*2015*		*2016*		*2017*		*2018 (As on 14.01.2018)*	
		C	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
1	Andaman & Nicobar	0	0	0	0	0	0	0	0	4	0	0	0	2	1	0	0
2	Andhra Pradesh	11	1	326	34	71	8	10	5	258	36	12	5	476	14	0	0
3	Arunachal Pradesh	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0
4	Assam	0	0	0	0	0	0	0	0	31	4	0	0	199	5	0#	0#
5	Bihar	1	0	0	0	0	0	0	0	352	6	0	0	26	0	0	0
6	Chandigarh	0	0	1	0	37	5	0	0	23	7	6	0	63	6	0	0
7	Chhattisgarh	0	0	10	3	1	1	0	0	239	53	6	4	305	64	0	0
8	Dadra & Nagar Haveli	0	0	0	0	0	0	0	0	26	6	1	0	15	4	0	0

9	Daman & Diu	0	0	0	0	0	0	0	0	5	1	0	0	6	2	0	0
10	Delhi	25	2	78	1	1511	16	38	1	4307	12	193	7	2835	12	8	0
11	Goa	7	0	9	0	0	0	1	1	193	19	6	0	260	12	0	0
12	Gujarat	7	4	101	30	989	196	157	55	7180	517	411	55	7709	431	4	0
13	Haryana	6	4	18	5	450	41	5	0	433	58	68	5	252	9	5	0
14	Himachal Pradesh	14	3	2	2	0	0	0	0	123	27	14	5	77	15	0	0
15	Jammu & Kashmir	13	1	0	0	76	2	0	0	495	20	2	0	139	25	8^^	6^^
16	Jharkhand	0	0	0	0	0	0	0	0	16	6	1	1	35	2	0	0
17	Karnataka	100	12	878	48	122	19	303	33	3565	94	110	0	3260	15	1	0
18	Kerala	210	10	623	14	10	1	62	15	928	76	23	1	1414	76	3	0
19	Lakshadweep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Madhya Pradesh	9	4	151	26	113	32	17	9	2445	367	38	12	802	146	2	0
21	Maharashtra	26	5	1551	135	643	149	115	43	8583	905	82	26	6144	777	1	0
22	Manipur	0	0	0	0	0	0	0	0	5	2	0	0	8	1	0	0
23	Meghalaya	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
24	Mizoram	0	0	0	0	20	1	0	0	4	0	0	0	0	0	0	0
25	Nagaland	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
26	Odisha	0	0	2	0	0	0	0	0	76	13	1	0	414	54	0	0
27	Pondicherry	1	0	63	2	0	0	0	0	57	4	1	0	168	9	0	0
28	Punjab	46	14	13	4	183	42	27	6	300	61	177	64	295	86	6	2
29	Rajasthan	36	11	343	60	865	165	64	34	6858	472	197	43	3619	279	355	19
30	Sikkim	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	Tamil Nadu	34	4	750	40	37	6	58	8	898	29	122	2	3315	17	3	0
32	Telangana*	-	-	-	-	-	-	78	8	2956	100	166	12	2165	21	5	0
33	Tripura	0	0	0	0	0	0	0	0	0	0	0	0	44	0	0	0
34	Uttarakhand	0	0	1	1	24	7	0	0	105	15	20	5	184	22	0	0
35	Uttar Pradesh	57	0	124	0	98	8	2	0	1578	50	122	16	3858	132	1^	0^
36	West Bengal	0	0	0	0	3	0	0	0	544	30	7	2	716	26	0	0
Cumulative Total		**603**	**75**	**5044**	**405**	**5253**	**699**	**937**	**218**	**42592**	**2990**	**1786**	**265**	**38810**	**2264**	**402**	**27**

^^ As on 13.01.2018; ^ As on 12.01.2018; #As on 07.01.2018

Abbreviations: C-Cases, D- Deaths

*****Telangana State has reporting separately since Nov, 2014 after separation from Andhra Pradesh Disclaimer: The reports on cases and deaths of seasonal influenza (H1N1) are based on the reports received from States/Uts to Central Surveillance Unit, Integrated Disease Surveillance Programme, NCDC, Delhi.
15.01.2018, Time: 03.20 PM

In an overpopulated, economically challenged country like India any infectious disease can raise its ugly head to epidemic proportions. Swine flu in India is causing panic due to virulent nature of the virus. The panic and terror about the disease are partly justified. [6]

Now let us look at factors that are probably responsible for swine flu outbreak.

Is the virus responsible?

This virus demonstrates all requisite characteristics of a pandemic strain as it is of sufficient virulence to cause human disease, and to a certain degree, humans are immunologically naive to the virus such that exposure can result in a productive infection and it can be passed from human to human. [7] With the infection spreading by sneezing, coughing and close contact and the virus can randomly combine with bird and pig influenza virus to produce new virus strains. [6]

Influenza A viruses lack a mechanism for correction of mistakes which occur during viral replication, this can result in changes to the surface proteins. The mechanism of continuous and relatively small changes that occur is known as "antigenic drift," produce new strains of virus within the same virus subtype. Because influenza vaccines induce antibodies to surface viral proteins, influenza vaccines change yearly to reflect the change in circulating strains. More substantial antigenic changes, called as "antigenic shift," occur more rarely and result in new subtypes by switching the combination of hemagglutinins and neuraminidases (e.g., H1N1 shifts to H2N2). The number of possible mechanisms for antigenic shift, includes the reassortment of human influenza viruses with avian or swine viruses, or significant point mutations of swine or avian viruses. Genetic reassortment may occur when a host cell is simultaneously infected with two influenza A viruses. During the reassembly of new virus particles, the RNA segments from the two strains can get mixed together, leading to the emergence of a third viral strain with a unique combination of genes. Pigs can be infected by both human and avian influenza viruses so it is an ideal mixing vessel for influenza A viruses. However this mixing can occur in other species, including humans. [8-12]A virus at time may remain hidden and re-emerge as a pandemic virus when the immunity in the population has waned. [13]

Has we entered into the age of pandemic?

Today when we compared our world with few years ago we are somewhat better prepared to deal with pandemic. We have better training, preparedness drill at all level, WHO obligations to report disease of global significance and two effective antiviral for influenza virus and some breakthrough to reduce the time required for vaccine production. But inspite of it today we remain underprepared for any pandemic outbreak, whether it comes from newly emerging infectious diseases, bioterror attack or laboratory accident.

We do not have the best general disease surveillance systems or "surge" capacity in our hospitals and health-care facilities. We do not have enough beds, respirators or seasoned public-health staff. We will face a broad array of dangerous emerging 2lst-century diseases, man-made or natural, brand-new or old, newly resistant to our current vaccines and antiviral drugs. The era in which infectious diseases are becoming more complicated by global challenges like climate change, global warming, air pollution, increasing population and urbanization, improper water management and flawed land use. [14]

Is India sufficiently prepared to tackle Swine flu?

Responsible Factors are-

1) Poor Surveillance
Though we have Integrated Disease Surveillance Programme (IDSP) which is supposed to receive samples on a regular basis from 11 laboratories that collect influenza samples, it has been blamed for being less active during years when there is no influenza outbreak and the current IDSP results are skewed and inaccurate. The surveillance officers collect samples only when there are deaths or only during flu season and not on a weekly and yearly basis, as they should.

Secondly besides H1N1, which is a type of influenza A virus, there is H3N2 and also influenza B, which causes similar symptoms and even death, but their data are not collected by our reporting system because they are not hyped.

Thirdly IDSP data is not integrated with private or public sector healthcare providers and with national vertical programmes like for tuberculosis, malaria, etc. IDSP just collects statistics. However in public health, surveillance statistics is not the primary and sole objective but it is side product and our focus instead should be on addressing social and environmental determinants that cause the disease. [15]

2) India lacks a dedicated public health cadre. Due to the absence of public health cadre, public health surveillance cannot be enforced and without surveillance it is impossible to know the magnitude, year-to-year variations, risk factors, strains, mortality rates, etc. of the virus. [15]

3) Flu vaccine is protective but we fail to promote it.[15] While vaccine effectiveness can vary, recent studies show that flu vaccination decreases the risk of flu disease by between 40% and 60% among the overall population during seasons when most circulating flu viruses are well-matched to the flu vaccine. [16] Vaccination is a critical input for preventing H1N1 influenza as it helps to develop herd immunity—in which large parts of the population are immune to the virus and slowing down its transmission. Flu vaccine gives protection for just 8-10 months, and a yearly flu vaccine is common in western countries. However in India there is little awareness about the vaccine. The research revealed that the coverage of seasonal flu vaccination is low (<5%) in most low- and middle-income countries but by making the vaccine free through the public healthcare system increases coverage. [15] Since the 2009 pandemic, H1N1 had became a seasonal flu virus strain in India even when the temperature in the country soars during the summer months. Seasonal flu vaccination is not part of India's national vaccination policy and our overall coverage of seasonal flu vaccine has been low. Vaccination of health-care workers and people in high-risk categories is important tool to reduce the toll. The guidelines for H1N1 vaccination of people belonging to high-risk categories such as pregnant women, very young and old people and those with certain underlying illnesses were released late by the Health Ministry is evidence that we have not learnt any lessons from the 2015 H1N1 epidemic. [17] The H1N1 vaccine is too expensive to be given universally but can be targeted at the vulnerable group such as the elderly, children, those with pre-existing chronic diseases, pregnant women and health workers. [15] Earlier in 2017, the National Institute of Virology in Pune had confirmed that the newer Michigan strain of swine flu - against which there are no effective vaccines - had made its way to Hyderabad and other parts of India. Before the discovery of the Michigan strain, it was mostly the California strain prevalent in the country. In March 2017 the World Health Organisation (WHO) had recommended replacing A/California/7/2009 (which has been in use as a vaccine strain since the 2009 swine flu pandemic) with A/Michigan/45/2015 vaccine to combat the newer strain of the H1N1 virus. But there was no availability of suitable vaccine on proper time. [18]

4) Despite the high cases , there is no system in place to release data periodically and frequently when compared with the regular updates provided by the U.S. Centers for Disease Control and Prevention, especially during an epidemic. There has also been a near-complete failure of our infra structure to spread awareness about prevention strategies in the community[17].

5) Early detection is important key.Seeking medical help as soon as the first symptoms arise is the key for better results. Deaths due to swine flu are commonly seen in those cases who are not treated on time and not taking complete course of medication. Again we failed to initiate measures for early detection of cases. [15]

The young children, elderly and those with pre-existing chronic conditions are more likely to contract the virus due to lower immunity. Since the virus spreads through air, young people are more affected as they are more exposed to overcrowded places like malls, trains, cinema halls, bus travelling and railway stations[15] and we failed to create proper awareness through Information Education and communication (IEC) in each and every section of the society, moreover there is knowledge-attitude gap which is prevalent in our society. [19]

Why the increase in swine flu cases in 2017 as compared to 2016?

Probable reasons may be-
1) It may be due to better national surveillance and better laboratory detection systems. [15]
2) By experts another reason is that the immunity acquired during previous outbreaks has diminished. Immunity develops either through an infection or by vaccination

wanes over time. After the 2015 outbreak when large populations would have been exposed to the virus, there were only 1,786 cases of H1N1 recorded in 2016. It is likely that there are more cases this year because fewer people are immune. [15]

3) By experts, the circulation of the new swine flu virus, the Michigan strain, in India in 2017 is one main reason which has contributed to the sharp rise in the cases of viral infection. The increased caseload and mortality this year compared with last year could be because pre-existing immunity through exposure to the California strain is now no longer effective, and people are therefore not immune to the new strain. [17,18]

So we can conclude that suspected factors behind failure to check spread of disease

- Unusual change in climate
- Lack of enough authorized testing centers.
- Limited timely availability of diagnostic facilities even in metro cities and Government setup
- Lack of Public awareness regarding the disease, vaccination, and treatment.
- Failure to rope in private-sector health care facilities adequately to handle the emerging epidemic
- Possible antigenic change in flu virus genetic makeup. [6]
- All the deaths may not have occurred only due to Influenza A H1N1 infection but may also be due to co-morbid conditions (Lung disease, liver disease, kidney disease, blood disorders, Diabetes etc.) and due to patients being Immuno-compromised. [20]

It seems that most of the emerging infectious disease (EID) are caused by pathogens which are already present in the environment in unnoticed form which got emerged when provided with favorable conditions and infect a new host. Sometime some of them evolve into a new variant and cause a new disease. Due to urbanization and destruction of natural habitats leading to close contact of humans with animals, the infectious agents tend to evolve into new ecological niches and reach and adapt to new hosts, and to spread more easily among the new hosts. Other contributory factors are climate change and changing ecosystems, microbial genetic mutation, and changes in population of reservoir hosts or intermediate insect vectors. International trade and commerce, lack of public health services and infrastructure, and antibiotic resistance, change in human demographics and behavior are also important factors in the emergence and re-emergence of infectious diseases. [21]

What should be done?

India being overpopulated and economically challenged country may continue to bear the shock of EIDs(emerging infectious disease) in the future and to tackle this menace we need measures like strengthening our surveillance and timely reporting systems, rapid response to the occasion by constituting rapid response team at every health institution and should be properly trained, and revamping our health infrastructure at all levels of health care system, empowered by qualified, experienced workforce and IEC activities.

There must be extension of diagnostic facilities at all district level for early diagnosis of cases. Though we have traditional system of medicine like Ayurveda, Yoga, Unani, Siddha, & Homeopathy along with allopathy, unfortunately in our country many people took treatment from non registered medical person especially in rural and tribal areas which delayed the start of proper treatment which is most important to save the life of patient in early golden hours of initial stage of disease.

We have primary health centre (PHC), community health centre (CHC) and tertiary heath care centre like government medical colleges and other referral centre. Unfortunately in these centre many posts of medical officers, specialists and other faculty members are vacant and private medical cost is beyond the capacity of large section of society and coverage of health insurance is low in the society so large section of society specially poor and rural and tribal community not getting proper health care so we should focus on this matter also.

Involvement of mass media is essentially important in spreading awareness besides involving community particularly in mitigating panic. We need to involve private sector in reporting and complying with government guidelines and thereby reducing underreporting.

As India is a nation of cultural festivals where large gathering and interaction among general masses occur so there are high risk of transmission in such circumstances so special precautions and watch must be made on it. Besides it comprehensive training of doctors in public health and epidemiology, basic microbiology, and clinical medicine is imperative. There must be sustainable international collaboration for prevention and control of emerging infectious disease like swine flu as the problem of EID is not restricted to any single country.

The important preventive measure against pandemic influenza is the production and administration of an effective vaccine and vaccination should be routine measure. Experience suggests that it may take many months to develop and administer a vaccine once the specific influenza strain has been identified. So during this period from outbreak to production and delivery of a safe and effective vaccine, the only armour against the pandemic is communication about how to minimize the risk of infection so comes the role of IEC through mass media.

International agencies like the WHO and the European Union (EU) recognize the importance of public communication campaigns as an essential element of the pandemic influenza planning response.

Vaccination is recommended for health care workers working in close proximity to influenza patients who are at higher risk of acquiring swine flu. As swine flu can directly be transmitted from one person to another through air droplets, people who fail to follow proper hygiene, especially in crowded places are at a high risk of contracting the virus. To avoid this proper preventive and control measures thus must be ensured. We have only limited treatment options, so rational use of the antiviral agent is very essential to avoid resistance and future complications. Health education and awareness among citizens should be transferred by proper mechanism.

Last but not the least we should focus our research in the way climate change is affecting disease patterns in human beings and animals and take measures to mitigate climate change by sustainable and climate friendly policies.

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