COVID-19 AND SCIENCE COMMUNICATION

Peoples' response in times of Corona crisis: a survey of indian public

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Abstract

The pandemic now known as COVID-19 crisis, took humanity by surprise. The highly infectious virus designated as SARS-CoV-2, with it epicentre in Wuhan City, crossed international boundaries at an unprecedented pace. Scientific community rose to the occasion, investigated etiology and clinical features, RNA sequence , pathological attributes, prognostic factors, transmission law and preventive measures, etc. of the virus [Harapan et al., 2020]. Usually, the cycle of generation of scientific knowledge, its publication in specialised journals, validation by international community of experts and then dissemination among the public is a time consuming process [Raza, Singh and Shukla, 2009]. The intensity of pandemic and risk involved reduced the time lag between generation of knowledge and its percolation among the lay public.

The scientific knowledge generated in laboratories, within a brief period, shaped perceptions and attitude of both the governments and the lay public. Emergent situations, especially life-threatening episodes also invoked myths, superstitions and conspiracy theories [Van Bavel et al., 2020]. Media channels publicised scientific information, myths, superstitions and conspiracy theories with equal zeal. However, the study conducted in India suggests that common citizens rejected myths, superstitions and conspiracy theories. In a short period of time common citizens gathered scientific information through multiple channels of media and used it to increase their health security. The authority of science was never so sharply delineated in a highly religious and traditional society. This article looks at the pandemic's disruptive nature, sudden changes in scientific knowledge, rapid crystallisation of perceptions and thereby attitudinal transformation and behavioural changes among the public in India.

Keywords Public perception of science and technology

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Introduction

Historians of science and medicine tell us that the notion of 'quarantine' is as old as human civilisation, yet Ibn Sina (an Iranian physician born in 980 and died in 1037,

often referred to as Avicenna in western literature) made 'important original contributions [which] include such advances as recognition of the contagious nature of tuberculosis; spread of diseases by water and soil; and interaction between psychology and health.' Based on this understanding he advised people to maintain social distance, especially in religious places and observe cleanliness [Hajar, 2013]. Centuries before the discovery of pathogens, both bacterial and viral, contagious nature of various diseases was known to human beings, and during the outbreak of epidemics, to varying degrees they practiced quarantine [Ziegler and Platt, 1998]. Tognotti tells us that the 'organised institutional responses to disease control began during the plague epidemic of 1347–1352 AD', when 'some city-states (in Europe) prevented strangers from entering their cities'[Tognotti, 2013].

The present pandemic

In recent times the notion of quarantine has gone through significant transformation. Tracing the origin of epidemic, identifying the pathogen, informing the public about likely symptoms, implementing necessary protocol, national border control, continuous surveillance and complete lockdown of economic, social, cultural and religious activities have become part of the implementation strategies. The complete lockdown activated by COVID-19 pandemic, with its epicentre in Wuhan, China, brought the entire world to a grinding halt. On the one hand, the interconnectedness of the globalised world caused exponential progression of the infection and, on the other hand, the all pervasive fear it generated triggered insatiable hunger for actionable information, which could protect a collective or individual from getting infected.

Surveys have repeatedly shown that before the crisis hit Wuhan City in China, the information about viruses in general and corona viruses in particular, was quite low among the lay public, world-over [Castro-Sánchez et al., 2016]. In December 2019, when the cases of an unknown pneumonia piled up, baffled scientists started probing the causes. Wuhan became the point of origin for both, the pandemic outbreak as well as the scientific information related to it [Huang et al., 2020].

On the 9th January, the Science reported 'Chinese scientists have identified a novel coronavirus — a pathogen family responsible for two other new diseases since 2003 — as the likely cause of the outbreak of an unusual viral pneumonia'. Virologists world over requested Chinese scientists to make the data public. Marion Koopmans urged that Chinese scientists must 'share the sequence data, so that we can all make sure we can test for this virus if we get travellers from this [Hubei province] region' [Normile, Cohen and Kupferschmidt, 2020]. Highly technical investigation and debate led to publication of research papers, popular articles, instructional videos, animation and discussions on TV and social media. Scientists and science communicator played an important role in disseminating the information to the public. Many websites and media channels reported national and international data of total and new infected cases, rate of deaths and recovery, hotspots and tests conducted, round the clock [Worldometer, 2020].

Evidently, as the fear and panic spread people searched for information, which could be used to ensure collective and individual safety. The scientific community, science communicators and media channels started shaping peoples' perception and it led to unprecedented and widespread attitudinal changes [Narayan, 2020]

A turning point in history of science communication

The pandemic spread fast and gripped almost the entire globe, it impacted every sphere of human life, economy. Even cultural and social life came to a grinding halt as most of the countries declared lockdown [Nicola et al., 2020]. Scientific journals started publishing research papers, in online preprint form, as soon as these were communicated, [Munafo, 2020]. Television channels and print media invited scientists and experts to appear in debates and write popular articles. The telecast time of science related to Corona virus increased many folds. Text messages, videos, animations and even cartoons and songs about Corona flooded the social media.

Scientific information guided peoples' actions

It is unprecedented in the human history that all economic, educational and collective religious activities suddenly stopped. The unthinkable happened, the religious leadership, after initial sporadic resistance, willingly closed mosques, temples, synagogues and churches [Burke, 2020]. Such widespread closure of religious places was unimaginable, in a traditional society like India, before the lockdown was declared on 24th March 2020 [The Economic Times, 2020]. These actions were based on the information generated and communicated by the scientists. For example COVID-19 virus was identified as the pandemic causing pathogen, leading to COVID-19, a form of pneumonia transmitted while touching surfaces loaded with viruses and inhaling aerosols, which an infected person releases during coughing and sneezing. The symptoms appear between periods of 2 to 11 days. The average incubation period was calculated to be 5.2 days [Li et al., 2020]. The pathogen is virulent and the fatality rate is high. Dissemination of this scientific information led to actions such as using masks, washing hands with soap or sanitising after touching an object or a surface, observing social distancing, if symptoms appeared people started observing quarantine for fourteen days. Finally it led to complete lockdown, closure of national borders and monitoring travel and contact history of corona positive patients. Remarkably, the authority of science and the latest scientific information guided each of these actions.

The attitudinal survey

Evidently, the clash of ideas during the crisis. Theories and information generated by scientists, competed with prevailing myths, superstitions, pseudo scientific believes and propounded conspiracy theories in public arena. In order to explore which of the ideas had impacted peoples' thought complex, relatively more intensely, authors initiated a questionnaire-based study. The objectives were:

- to probe the efficacy of various channels of information in communicating different ideas;
- to map out the level of scientific information among the public;
- to examine the extent of attitudinal changes that the scientific information has brought about;
- and the prevalent risk perception of contracting the disease.

One of the long-term objectives of the study was to examine if the pandemic has created a permanent new normal or the society will gradually slide back to the old

one. In other words, we decided to study the overall resilience effects of the lockdown and see if the behavioural changes, which the present debate has enforced, will continue even after the lockdown is lifted. The pandemic presented a unique opportunity to initiate such a study. However for an investigation of this nature collecting data during the lockdown was important so that later surveys could help in comparing the rate and extent of shifts in perceptions and attitudes.

Authors, based on the above understanding, prepared a fairly big repository of indicators. The questionnaire finalised after consultation with experts contained 45 indicators, 8 for constructing control variable and 37 for probing the public understanding of science [Raza, Singh, Kumar et al., 2020].

About 3500 persons were contacted requesting them to fill a semi-structured questionnaire during the month of May 2020, out of which 2780-(1694 English-online, 586 Hindi-online and 500-offline printed questionnaires) responded to our call. Due to lockdown, we could not approach potential respondents in most cities directly, therefore, we sent link of online form with an appeal to it fill-in. We also wanted to collect responses from those who could not be contacted though social media or email. In cities where we were able to request volunteers to distribute and collect questionnaires, in their neighbourhood, we sent e-copy through email. Volunteers took printouts at their end and sent us the images of each filled-in page for data entry. India is a multilingual country and this poses a serious problem for any survey. The two, Hindi and English have emerged as link languages and it is easier to find respondents and volunteers who can understand and translate the questions in local or regional languages. In short, collection of data in a multi-ethnic, multi-lingual and multi-cultural society is complex undertaking.

The first phase of data collection commenced on 7, May, 2020, and concluded on 21, May, 2020. In future we plan to carryout similar data collection twice with gap of about six months. Weeding out unusable filled-in questionnaires required review of each response, those which did not carry all the information about independent variables (state, age, gender, education, occupation, sources of information, etc.) were rejected. In total 2223 valid responses were subjected to statistical analysis.

The sampled population

The final sampled population represented participants from 27 provinces of India. The percentage distribution was uneven and north centric. Age-wise distribution showed a bell-shaped curve with a range of 15 to 80 years with a peak around age band 30–40 years. Of all 37% were women and 62% were men. The sampled population was skewed towards higher levels of education. Of all the respondents about one-third were postgraduate, however respondents in all levels of education were represented, in statistically significant numbers. Moreover, respondents were put in 12 categories of profession and percentage distribution showed that teachers (14.6%), students (17.8%), those in government or private service (24.1%) and self employed professionals (14.7%) responded to the questionnaire in comparatively larger numbers.

The respondents were asked to furnish details of basic amenities at home. The percentage distribution showed that about 3.4% did not have electricity at home and about 13% were without a running water connection, more than 30% of the respondents did not did not own a personal mode of transport, which had become

Table 1. Background of the sampled population.

SN	Variable	Response (percentage)			
1	Gender	Male	63.0	Female	37.0
2	Age	<20 yrs	15.3	41–50 yrs	17.8
		21–30 yrs	24.3	51–60 yrs	11.2
		31–40 yrs	22.0	>60 yrs	7.3
3	Education	Up to 8th	5.9	Graduate	27.8
		Secondary	8.1	Post-graduate	31.2
		Sr. Secondary	13.1	M.Phil/Ph.D.	10.2
4	Occupation	Student	17.8	Professional	7.1
		Service	24.1	Social-work	4.8
		Self-employed	7.6	Agriculture	0.8
		Business	3.2	Household	4.8
5	Facilities at home	TV	89.4	Two-wheeler	66.4
	(Multiple choice)	Electricity	96.6	Car	54.5
		Running water	87.3	Refrigerator	88.2

extremely important during the crisis. Of all 90% reported that they have a television set and 88% had a refrigerator to store the perishable food, at home. Largest number of respondents reported that they received information about Corona virus through Internet (78.2%) and TV (76.1%). On the percentage scale newspaper scored (63.7%) the third position, followed by Mobile phones (56.8%) and WhatsApp (55.6%). Only 15.5% respondents reported that they received information through radio. It should be noted that most people did not depend on a single source, they sought and received information through multiple channels.

Earlier studies have suggested that, on the one hand, in times of natural or man-made disasters, peoples' receptivity for both, usable as well as expandable information increases many folds [Eriksson, 2018], and on the other hand, the efficiency of information channels in imparting knowledge also rises exponentially [Coombs and Holladay, 1996]. In response to the question 'Which source of information did you trust most', Internet (59.4%) occupied the first position followed by TV (57.7%) and Newspaper (35.3%). Mobile phones (15.1%), WhatsApp (10.1%), friends (7.3%) and Radio (6.4%) were not considered trust worthy by majority of respondents.

Public understanding of science during the crisis

The first question in the second section of the schedule was 'What is a virus'. Analysis showed that 61% respondents believed that 'the viruses cannot survive without a host cell' and 26.2% ticked the option 'it can grow on its own'. When asked 'Which virus caused panic in the recent past' 82.3% ticked the correct name, Corona/COVID-19 and 87.0% knew that it had originated in the city of Wuhan. It can be safely assumed that almost all the respondents had not heard about 'Wuhan City' before the outbreak.

As early as in January, Chinese scientists had reported that SARS-CoV-2 is a positive-sense single-stranded RNA virus of approximately 27–32 kb. It belongs to the family Coronaviridae, which comprises of alpha, beta, delta, and gamma

Table 2. Sources of information, trust and knowledge about the virus.

SN	Question	Responses (percentage)				
1	Source of information about COVID-19 (Multiple choice)	TV 76.8 Mobile 56.8 Friends 37.5 WhatsApp 55.6		News-paper 63.7 Radio 15.5 Internet 78.2		
2	Which source of information do you think is most trusted? (Multiple choice)	TV 57.7 Mobile 15.1 Friends 7.3 WhatsApp 10.1		News-paper 35.3 Radio 6.4 Internet 59.4		
3	What is a virus?	Grows in other cell 61.0	Grows on its own 26.0	—	God knows 3.0	Don't know 9.0
4	Which virus caused panic in the recent times?	Corona 82.3	SARS 13.0	MERS 2.2		Don't know 2.1
5	From which place the virus originated?	Wuhan 87.0	Beijing 1.5	Guanzhao 1.2	China 7.6	Don't know 2.4
6	Present corona virus contains the genetic material as	RNA 39.7	DNA 10.2	Both 16.7	None 16.2	Don't know 15.4
7	The COVID-19 virus is thought to have come from animals, which animal do you think it has come from	Bat 83.7	Wild cat 2.7	Camel 0.4	God knows 2.4	Don't know 10.2
8	Human to human transmission of the virus is possible through	Aerosol 74.3	Breathe 18.7	—	God know 1.9	Don't know 4.5
9	Is transmission possible through cough and sneezing?	Yes 93.1	No 3.3			don't know 3.1
10	Is corona virus natural or manmade?	Natural 41.7	Manmade 31.9	Others 0.9		Don't know 24.1
11	Do you know what is the shape of the virus?	Sphere with Spikes 79.5	Thread-like 4.2	Bulb-shaped 1.9		Don't know 13.5
12	Virus has a covering sheath made of	Protein 38.8	Fat 26.5	Carbo-hydrate 6.1	Others 7.1	Don't know 18.5
13	On which surface virus can survive for longer period?	Plastic 27.4	Paper 6.1	Metal 43.3	Wood 8.8	Don't know 14.2

coronaviruses [Huang et al., 2020]. About a month later a team of Korean scientists confirmed these results [Kim et al., 2020], soon many other international teams of experts also validated the findings. Various media channels popularised the jargon ridden, complex scientific information related to coronaviruses, in simple language, and repeated messaging helped its absorption within peoples' cultural thought structure. When probed, of all 39.7% respondents knew that COVID-19 causing virus is RNA-based. About thirty per cent either did not respond or said 'Don't Know'. About 10% thought that it is RNA-DNA based pathogen, and 16.7% believed it contains only DNA.

Table 3. Perception and information about the pandemic and disease.

SN	Question	Response (percentage)				
1	What is/are the symptom/s of the infection?	Cough 9.7	Fever 2.4	Breathing problem 4.7	All of these 63.2	Don't know 18.0
2	Which is the disease Corona virus causes?	Pneumonia/ Throat infec 79.1	Any disease 10.0	—	God knows 1.4	Don't know 7.9
3	Many people get well even after the infection, what is the reason?	Immunity 91.8	By chance 2.0	God's grace 2.6	—	Don't know 3.5
4	In case of symptoms, what should be done	Consult a doctor 79.5 Quarantine at home 14.8 Leave it to God 1.0		Inform the police 6.8 Doing nothing 0.5 Don't know 0.7		
5	How can we prevent COVID-19 infection?	Social distancing 24.3	Mask 20.7	Sanitizer 20.8	Washing hands 15.6	All of these 89.2
6	When do you think a person will show symptoms of COVID-19 virus infection?	2–11 days 26.2	14 days 64.1	2–3 days 5.0		Don't know 3.9
7	Will social distancing eradicate the virus or only retard its spread?	Retard 72.3	Eradicate 18.0	—	God knows 3.7	Don't know 6.0
8	Do you think virus is death causing or people can recover?	Death-causing 8.7	Recover 84.5	God knows 2.8		Don't know 2.9
9	What test do doctors conduct to confirm the infection of COVID-19?	PCR 68.1	Blood 14.3	Fever 8.5	Others 0.8	Don't know 7.3
10	Are you afraid of Corona infection while going out?	Yes 64.0	No 18.1	Maybe 16.7	—	Don't know 3.2
11	People say the 'scientists are trying to invent medicine/vaccine for COVID-19, will they succeed?	Yes 75.4	No 6.1	God knows 8.4		Don't know 8.7

Another research paper published on Feb 3, 2020 in Nature informed 'that 2019-nCoV is 96% identical at the whole-genome level to a bat coronavirus' and concluded '[w]e do not yet know the transmission routine of this virus among [the] hosts' [Zhou et al., 2020]. The scientific information about transmission from bat to humans has not progressed much since then. The channels of information popularised the fact that the novel corona virus came from Bats. Evidently, the information travelled far and wide at a fast pace and analysis showed that 83% of all the respondents were aware that bat is a natural host of SARS-CoV-2.

By the time WHO issued an international warning, in January 2020, the infection had already crossed Chinese borders. The scare that it is life threatening and spreads through human contact, created acute panic all over the world. Various photographs, sketches and even artistic impression of the SARS-CoV-2 virus circulated on media channels became part of the memory of common citizens. Analysis of the data revealed that 78.1% respondents were able to recalled a correct image, i.e., spherical shape with spikes. However, when asked 'what material the

Table 4. Opinion about policies and behavioural changes.

SN	Question	Response (percentage)				
1	Which of the following actions can prevent infection? (Multiple choice)	Using cow dung 2.2 Clapping 3.5 Using chillies and lemon 7.7 Don't know 26.6		Chanting prayer 5.2 Switching off lights 2.6 None of these 67.8		
2	Who has spread the virus in the country?	People coming from abroad 74.4 Poor people 0.3 Don't know 4.0		Rich people 4.4 Muslim/Tablighi Jamat 4.9		
3	All religious places have been closed during lockdown, was it a correct decision?	Yes 88.7 Against religion 1.4		No 5.7 Don't know 3.0		
4	Country needs more hospitals or religious places.	Hospitals 89.2 Don't know 4.3		Religious places 4.4		
5	In your opinion lock down created more problems or helped us overcome the pandemic?	Problem 30.9	Overcome 54.7	Should have left as such 2.7		Don't know 9.8
6	What was the biggest problem you faced during the lockdown?	No 24.3	Grocery procure 16.0	Loss of earning 21.8	Hunger 3.1	Movement 30.8
7	Do you think wearing face mask, washing hands etc. must continue even after lock down?	Yes 84.8	No 9.4	Maybe 4.9	—	Don't know 1.9
8	Do you think you will adhere to safety measure like not shaking hands, avoid hugs, etc., in future?	Yes 81.0	No 12.0	—	—	Don't know 6.2

outer shell of the virus is made of', only 38 per cent of the respondents knew that the RNA is enveloped in a protein layer.

Scientist quite early on, had also communicated that 'Transmission (of SARS-CoV-2 virus) is usually via airborne droplets of the nasal mucosa' [Peng et al., 2020]. This information popularized by science communicators and media channels in easy language also warned common citizens that airborne droplets which settle down on hands and various surfaces transmit virus through touch. The data analysis revealed that 74% respondents believed that it spreads through human contact, 93.1% knew that COVID-19 causing virus multiplies in throat and nasal cavity and then enters lungs, and 79.1% said that it causes pneumonia, and comes out while sneezing and coughing, in the form of aerosols.

A group of scientist 'evaluated the stability of SARS-CoV-2 and SARS-CoV-1 in aerosols and on various surfaces and estimated their decay rates' and came to the conclusion that 'SARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard, and viable virus was detected up to 72 hours after application to these surfaces' [van Doremalen et al., 2020]. The analysis showed that about 70% of the respondent could identify metal and plastic as two substances, on which they believed that the virus can survive for the longest period.

The percentage distribution of various responses clearly showed that cultural distance between the information generated within the scientific institutions and

the social life of common citizens reduced considerably and peoples' perceptions and attitudinal changes were rooted in recently acquired scientific knowledge. Of all, 90% of the respondents believed that social distancing, using masks and sanitiser, and washing hands frequently will reduce the communicability of the disease. Therefore, an over whelming percentage of the respondents voted for closing down religious places (88.7%), maintaining social distance (80%) and continued safety measures recommended by the scientist (84.8%). Earlier studies have also reported reduction of cultural distance between scientific information and peoples' cultural thought complex during natural disasters, in and for a brief period of time [Raza, Singh, Kumar et al., 2020].

Rejection of myths, superstitions and conspiracy theories

It has been pointed out in preceding paragraphs that during the past few years scientific rationality and science communicators were constantly attacked in India [Sukumaran, 2018]. In this national socio-political backdrop the authority of science was repeatedly challenged by theories base on conjectures and outmoded ideas. Evidently, during the period 1st of March to 15th of April, the authors recorded 72 news items which reported incidents of suggested or practiced myths and superstitions. Various media channels, both local and national, also propagated conspiracy theories which blamed a section of religious or social minority for spreading the virus. There were 26 reported cases of social and religious 'othering' where the members of minority groups were killed, physically attacked or disallowed from performing normal economic and social activities.

The media actively and widely circulated myths, superstitions, pseudo scientific views and conspiracy theories, yet the data analysis shows that the majority of the sampled respondents did not subscribe to these unsubstantiated stories. For example, TV and social media extensively propagated that 'Tablighi Jamat', a fundamentalist Muslim organization, had conspired to deliberately spread the virus in the country, but in answer to the question 'Who has spread the virus', 74.4% replied that those who traveled abroad are responsible for spreading the pandemic. Only 4.8% held Tablighi Jamat members responsible. The other most widely circulated myths were that 'application of cow dung on the body or drinking cow urine will cure COVID-19, only 2.2% believed it. Similarly, switching off lights, clapping, chanting especial prayers and hanging chilly and lemon on the entrance door of the house scored 2.6%, 3.5%, 5.2% and 7.7%, respectively. Of all 60% of the respondents positively rejected all these superstitious believes and about 26% were noncommittal and said 'don't know'.

Conclusions

Over the centuries, the idea of quarantine and social distancing during a epidemic had already become a socially accepted norm, however, in recent times, new dimensions have been added to it. The COVID-19 crisis witnessed an unprecedented response from the scientists, science communicators, media channels and the public at large. The efficacy of media channels in communicating science to the public increased many folds and the receptivity of scientific information among the public also grew exponentially during the period of crisis. As the pandemic hit the unprepared governments, the lay public and even the religious leadership accepted the authority of science and subsequently, the policies and actions were shaped by the information generated in laboratories. Though the

media channels communicated scientific as well as superstitious and mythical information, the common citizens almost completely rejected the unscientific assertions and conspiracy theories. Even in highly religious and so-called 'spiritual' society like India, a minuscule minority believed that superstitions such as application of cow dung or drinking cow urine will protect them from the pandemic. The actions such as social distancing, quarantine, sanitisation and washing hands frequently, were guided by the scientific information generated in laboratories, communicated to the public thorough various channels of media and absorbed by the common citizens.

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