High temperature and high relative humidity significantly slow spread and death of Novel Corona Virus covid-19

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Abstract

The main route of Corona Virus infection is presumed to be respiratory droplets. The transmission of the virus at different temperature and relative humidity were studied. The more stability of novel corona virus prevail at low temperature and low humidity environments. High temperature and high relative humidity significantly reduce the transmission and death of novel corona virus. An increase of one degree Celsius and one percent relative humidity increase substantially lower the virus's transmission. This research indicates the direct impacts of air temperatures and relative humidity levels could be seen plainly in the severity of outbreaks during the earlier stages of the virus spread. Research found that countries with warmer and more humid climates like Bangladesh, Malaysia, Thailand, Singapore, Vietnam and other South Asian countries saw a lower transmission and death. Meanwhile countries and states experiencing high transmission and death rate in European countries and United States including Italy, Spain, New York, New Jersey, Michigan, Missouri, Washington states and so on where weather pattern similar to origin hotspots Hubei and Hunan with mean temperature 3 to 17 degree Celsius. A higher temperature such as 30 degree Celsius to 40 degree Celsius reduced the spreading and duration of persistence of highly pathogenic novel corona virus. Bangladesh is more potential for spreading of novel corona virus because of its high dense population, lack of health awareness and more community spreading. Temperature and Humidity is higher then that of Hubei (China), Europe and New York for that region transmission and death rate of novel corona virus reduced significantly in Bangladesh. If community spreading happens then high temperature and relative humidity not activate properly. spreading but it can reduce the severity of virus in human bodies and death.

Keywords: NCoV19, Temperature, Humidity, Quarantine, Isolation, Transmission, pandemic, Social distance, Mask etc.

1. Introduction

Novel Corona Virus was a new emerging disease. It emerged in Wuhan, China December 2019 and has spread to 218 countries and territories in the World. This spreads primarily through droplets generated when an infected person coughs or sneezes, or through droplets of saliva or discharge from the nose. The disease is presumed to be spread direct or indirect contact. Person to person transmission has been both in hospital and family settings. Human mobility from China to other nations spreading the novel corona virus places like USA, Europe and Asian countries. People of all ages can be infected by the new corona virus. The most common symptoms are fever, cough, shortness of breath, and breathing difficulties. In more severe cases infection can cause pneumonia, severe acute respiratory syndrome, and even death. Older people and people with pre-existing medical conditions such as asthma, diabetes and heart disease appear to be more vulnerable to becoming severely ill with the virus. The World Health Organization declared the outbreak a pandemic. In the early dates of the outbreaks countries with relatively lower air temperature and lower humidity like South Korea, Japan, Iran, Europe, New York, shows severe outbreaks than warmer and more humid countries like Bangladesh, Malaysia, Thailand, Singapore, India and Indonesia. The flu virus and other respiratory viruses cause colds tend to survive best in low humidity conditions.

2. OBJECTIVES

The objectives of this research can be summarized as follows:

1) To understand the relationship between weather and the transmission of novel corona virus covid-19.

2) To estimate the spreading intensity of the epidemic novel corona virus covid-19.

3. Data Collection

The researcher used Temperature and Relative humidity catalog data collected from Bangladesh Meteorological Department and novel corona virus cases in Bangladesh such as active cases, death, tested numbers and recoveries from Institute of Epidemiology Diseases Control and Research (IEDCR).

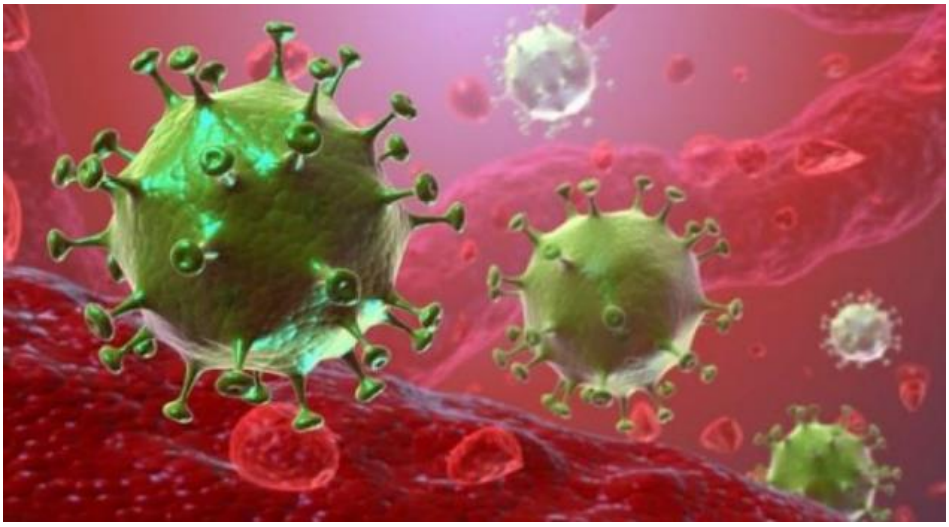

Figure 1: A simulation of novel corona virus NCoV-19

4. Methodology

Researcher examined climate data from different cities with significant community spread of covid-19 and compared to areas that are either not affected, or do not have significant community spread. Consider temperature and humidity from February to April to compare the severity of the corona virus outbreaks. Statistical comparison method used to compare temperature and humidity in more spreading regions and found that cities in Northern China where temperature and relative humidity were lower had larger transmission values than cities along the South east coast of China. Even in the USA, the outbreak was visible across the North-South drive with the more in Northern States having much higher transmission compared to Southern States such as Texas, New Mexico and Arizona. Similar situation happened in Europe where temperature and humidity condition is the key factor.

5. RESULT AND DISSCUSION

In Bangladesh on 7 March the first corona virus case was detected. IEDCR confirmed it on 8 March 2020. Total 64 districts are infected the novel corona virus. Among them Dhaka, Narayanganj, Gazipur, Munshigonj, Norshingdi, Chattogram was the most infected please in the country. First infected 44 persons 17 had travel history in Italy, USA, Bahrain, Kuwait, India, Saudi Arabia, European countries and so on. Viruses are spreading in communities by them. Research found that the severity of spreading is related to temperature, relative humidity and close connection with each other without mask ware. In this study researcher showed that high temperature at high relative humidity and health awareness has synergistic effect on inactivation of novel corona virus while lower temperatures and low humidity and human close connection support prolonged survival of virus on contaminated surface. Bangladesh is relatively high dense populated country than that of Europe, USA, and China. Spreading and death rate of corona virus in Bangladesh is comparatively lower than that of Europe, USA, China and so on. Temperature is one of the key factor for this lower transmission and

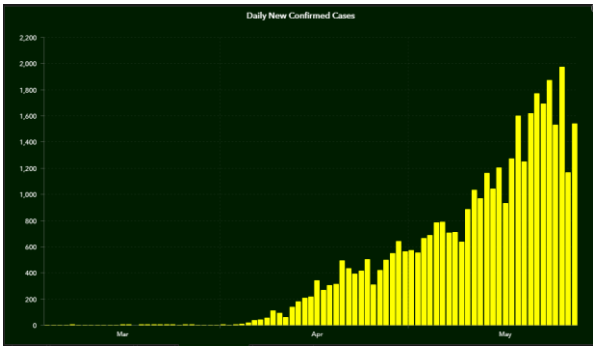

Figure 2: Daily positive cases in Bangladesh

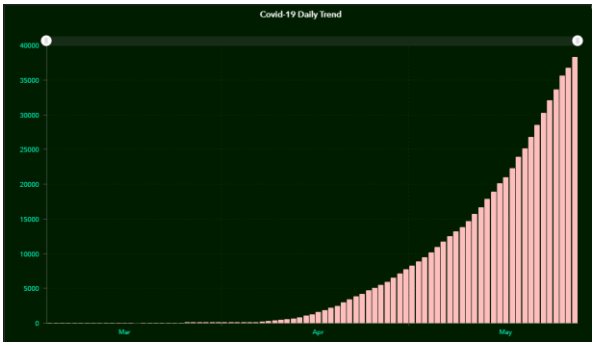

Figure 3: Cumulative positive cases in Bangladesh

death, It is observed that home quarantine, social distances and health awareness of Europe, USA, China is much better than that of South Asian countries like Bangladesh, Nepal and India. More testing indicates more infected cases if the testing facilities are more in the starting time in Bangladesh spreading of virus not prolonged in more time. Also social distances, mask ware and institution quarantine is the key point for reducing community spreading of virus. Only lack of health awareness, mask ware and social distances in Bangladesh and India community spreading increased significantly. When community spreading happens then high temperature and relative humidity not activate properly.

The temperature of countries such as Malaysia, Indonesia, Thailand, Bangladesh, Vietnam are those not conductive to the prolonged survival of the virus. Only for close connection and lack of health awareness of the infected person is the main source for community spreading and prolonged the virus. Also health experts agreed cold weather is a factor in containing and spreading the outbreak.

Research found countries with warmer and more humid climates, like Singapore, Malaysia, Thailand, Vietnam and other Southeast Asian countries saw a lower growth rate. Meanwhile, countries and states experiencing high growth rates, including Italy, Span, United Kingdom and, in the U.S., New York and Washington states. Exhibit weather patterns similar to original hotspots of Hubei and Hunan with mean temperatures between 3 and 10 C in February and March. A similar phenomenon was observed many of the corona virus hotspots all existed in a temperature zone between -1 and 10 degree C. On the other hand when community transition happened then temperature is the less active parameter of virus spreading but it can reduce the severity of virus in human bodies and death.

March to May is summer season and nor-wester period in Bangladesh. Average normal temperature is greater than 30 degree Celsius over the country. Some where the maximum temperature is about more than 38 degree C. This high temperature and relative humidity suggested that the transmission would be significantly reduced in time. Comparison of low temperature and high temperature zone it was significantly observed difference of the spreading and death rate. Also transmission of virus can be affected by a number of factors including climate conditions, population density, health awareness of the peoples, proper maintain of social distancing, mask ware and medical care quality.

Government of the peoples Republic of Bangladesh closed Government offices and private offices except those involved in emergency services such as law enforcement agencies and hospitals in proper time for reducing the community transmission of novel corona virus. People have been asked to practice social distancing and stay in their homes as much as possible. Local administrations around the country have been asked to encourage social distancing, mask ware among people and armed forces division helps them in this regard. But peoples are not much aware and concentrate in mind. Social distancing, mask ware home quarantine, isolation can reduced community transmission of novel corona virus.

Table- 1: IEDCR daily dada Information in Bangladesh

	Cases in Bangladesh as reported by IEDCR			**In the last 24 hours**				
Date	**Cumulative Tested From 2020-01-21**	**Cumulative Cases**	**Cumulative Deaths**	**Cumulative Recovered**	**Newly Tested**	**New Cases**	**New Deaths**	**Newly Recovered**
2020-03-08	111	3	0	0	25	3	0	0
2020-03-11	142	3	0	0	31	0	0	0
2020-03-13	163	3	0	0	21	0	0	0
2020-02-14	187	3	0	0	24	0	0	0
2020-03-15	211	5	0	2	24	2	0	2
2020-03-16	231	5	0	2	20	0	0	0
2020-03-17	241	8	0	3	10	3	0	1
2020-03-18	277	10	0	3	36	2	0	0
2020-03-19	351	14	1	3	74	4	1	0
2020-03-20	397	17	1	3	46	3	0	0
2020-03-21	433	20	1	3	36	3	0	0
2020-03-22	466	24	2	5	33	4	1	2
2020-03-23	564	27	2	5	98	3	0	0

	Cases in Bangladesh as reported by IEDCR			In the last 24 hours				
Date	Cumulative Tested From 2020-01-21	Cumulative Cases	Cumulative Deaths	Cumulative Recovered	Newly Tested	New Cases	New Deaths	Newly Recovered
2020-03-24	620	33	3	5	56	6	1	0
2020-03-25	712	39	4	5	92	6	1	0
2020-03-26	794	39	5	11	82	0	1	6
2020-03-27	920	44	5	11	126	5	0	0
2020-03-28	1,026	48	5	11	106	4	0	0
2020-03-30	1,113	48	5	17	87	0	0	6
2020-03-31	1,233	51	6	22	120	3	1	5
2020-04-01	1,356	54	6	25	132	3	0	3
2020-04-02	1,506	56	6	25	141	2	0	0
2020-04-03	2,019	61	6	26	513	4	0	1
2020-04-04	2,453	70	8	30	434	9	2	4
2020-04-05	2,820	88	9	33	367	18	1	3
2020-04-06	3,288	123	12	33	468	35	3	0
2020-04-07	4,080	164	17	33	792	41	5	0
2020-04-08	5,061	218	20	33	981	54	3	0
2020-04-09	6,168	330	21	33	1,097	112	1	0
2020-04-10	7,252	424	27	33	1,084	94	6	0
2020-04-11	8,206	482	30	36	954	58	3	3
2020-04-12	9,457	621	34	39	1.251	139	4	3
2020-04-13	11,027	803	39	42	1,570	182	5	3
2020-04-14	12,932	1,012	46	42	1,905	209	7	0
2020-04-15	14,672	1,231	50	49	1,740	219	4	7
2020-04-16	16,691	1,572	60	49	2,019	341	10	0
3020-04-17	18,881	1,838	75	58	2,190	266	15	9
2020-04-18	20,995	2,144	84	66	2,114	306	9	8
2020-04-19	23,629	2,456	91	75	2,634	312	7	9
2020-04-20	26,408	2,948	101	85	2,779	492	10	10
2020-04-21	29,187	3,382	110	87	2,779	434	9	2
2020-04-22	32,283	3,772	120	92	3,096	390	10	5
2020-04-23	35,699	4,186	127	108	3,416	414	7	16
2020-04-24	39,385	4,689	131	112	3,686	503	4	4
2020-04-25	42,722	4,998	140	113	3,337	309	9	1
2020-04-26	46,198	5,416	145	122	3,476	418	5	9
2020-04-27	50,010	5,913	152	131	3,812	497	7	9
2020-04-28	54,342	6,462	155	139	4,332	549	3	8
2020-04-29	59,310	7,103	163	150	4,968	641	8	11
2020-04-30	64,275	7,667	168	160	4,965	564	5	10
2020-05-01	69,848	8,238	170	174	5,573	571	2	14
2020-05-02	78,638	8,790	175	178	5,827	552	5	3
2020-05-03	84,006	9,455	177	178	5,368	665	2	0

	Cases in Bangladesh as reported by IEDCR			In the last 24 hours				
Date	Cumulative Tested From 2020-01-21	Cumulative Cases	Cumulative Deaths	Cumulative Recovered	Newly Tested	New Cases	New Deaths	Newly Recovered
2020-05-04	90,266	10,143	182	1210	6,260	688	5	147
2020-05-05	95,977	10,929	183	1403	5,711	786	1	193
2020-05-06	1,02212	11,719	186	1780	6,241	790	3	377
2020-05-07	1,08079	12,425	199	1,910	5,867	706	13	130
2020-05-08	1,14020	13,134	206	2101	5941	709	9	191
2020-05-09	1,19485	13,770	214	2414	5465	636	8	313
2020-05-10	1,25127	14,657	228	2,650	5642	887	14	236
2020-05-11	1,32555	15,691	239	2902	7208	1034	11	252
2020-05-12	1,39328	16,660	250	3147	6773	969	11	245
2020-05-13	147228	17,822	269	3,361	7900	1162	19	214
2020-05-14	154620	18,863	283	3603	7392	1041	14	242
2020-05-15	1,63202	20,065	298	3882	8582	1202	15	279
2020-05-16	1,69984	20,995	314	4,117	6782	930	16	235
2020-05-17	178098	22,268	328	4373	8114	1273	14	256
2020-05-18	187886	23,870	349	4585	9,788	1602	21	212
2020-05-19	196335	25,121	370	4993	8449	1251	21	408
2020-05-20	206542	26,738	386	5207	10,207	1617	16	214
2020-05-21	216804	28,511	408	5602	10,262	1773	22	395
2020-05-22	226531	30,205	432	6190	9727	1694	24	588
2020-05-23	237365	32078	452	6486	10834	1873	20	296
2020-05-24	246273	33610	480	6901	8908	1532	28	415
2020-05-25	255724	35585	501	7334	9451	1975	21	433
2020-05-26	261187	36751	522	7579	5463	1166	21	245
2020-05-27	269202	38292	544	7925	8015	1541	22	346
2020-05-28	278512	40321	559	8425	9310	2029	15	500
2020-05-29	289813	42844	582	9015	11301	2523	23	590
2020-05-30	299800	44608	610	9375	9987	1764	28	360
2020-05-31	311676	47153	650	9781	11876	2545	40	406

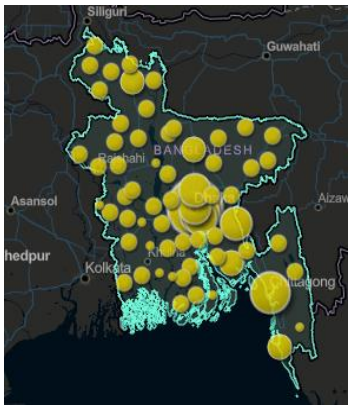

Figure 4: Location of positive cases in Bangladesh

Figure 5: worldwide positive cases

Table- 2: Monthly normal temperature and humidity in different cities in the world

	Kualalumpur, Malaysia			Jakarta, Indonesia		
Month	Temperature	Humidity	Discomfort from heat and humidity	Temperature	Humidity	Discomfort from heat and humidity
Jan	32	97	High	29	95	High
Feb	33	97	High	29	95	High
March	33	97	High	30	94	High
April	33	97	High	31	94	High
May	33	97	High	31	94	High
June	33	96	High	31	93	High
July	32	95	High	31	92	High
Aug	32	96	High	31	90	High
Sept	32	96	High	31	90	High
Oct	32	96	High	31	90	High
Nov	32	97	High	30	92	High
Dec	32	97	High	29	92	High

	Bangkok, Thailand			Singapore		
Month	Temperature	Humidity	Discomfort from heat and humidity	Temperature	Humidity	Discomfort from heat and humidity
Jan	32	91	High	30	82	High
Feb	33	92	High	31	77	High
March	34	92	High	31	76	High
April	35	90	Extreme	31	77	High
May	34	91	Extreme	32	79	Extreme
June	33	90	Extreme	31	79	High
July	32	91	High	31	79	High
Aug	32	92	High	31	78	High
Sept	32	94	High	31	79	High
Oct	31	93	High	31	78	High
Nov	31	92	High	31	79	High
Dec	31	91	High	31	82	High

USA			
Month	Average Sunlight (hours)	Temperature	Humidity
Michigan	6.6	6.9	81
Colorado	8.5	7.3	67
New York	6.9	7.4	81
Massachusetts	7.2	8.8	81
Washington	6.9	9.1	67
Oregon	6.4	9.1	81
Utah	8.3	9.2	81
Nebraska	7.6	9.3	67
Connecticut	7.1	9.4	81
Nevada	10.4	9.9	81
Rhoda Island	7.1	10.1	67
Ohio	6.0	10.4	81
Indiana	6.7	10.9	81
West Virginia	7.8	11.0	67
New Jersey	6.8	11.5	81
Maryland	7.1	12.3	81
Kansas	7.7	12.4	67
Missouri	7.7	12.5	81
Virginia	7.4	12.8	81
Kentucky	6.9	13.1	67
North Carolina	7.7	15.0	81
California	9.9	15.2	81
Oklahoma	8.5	15.3	67
Arizona	10.6	15.7	81
South Carolina	7.7	16.9	81
Mississippi	7.1	17.4	67
Georgia	7.5	17.5	81
Taxes	7.2	18.2	81
Florida	7.9	21.5	67

Table- 3: Maximum Temperature and Humidity in Bangladesh, 2020

March 2020				April 2020			
Date	Temperature (°C)	Humidity	Discomfort from heat	Date	Temperature (°C)	Humidity	Discomfort from heat
01	33.0	67	High	01	37.8	66	Extreme
02	32.5	85	High	02	38.5	66	Extreme
03	32.0	81	High	03	37.0	92	Extreme
04	32.8	59	High	04	37.8	75	Extreme
05	31.8	55	High	05	37.5	72	Extreme
06	30.8	75	High	06	38.2	65	Extreme
07	31.5	88	High	07	39.2	70	Extreme
08	31.7	77	High	08	39.0	68	Extreme
09	32.0	61	High	09	37.5	72	Extreme
10	31.4	68	High	10	39.2	72	Extreme
11	33.0	74	High	11	37.5	82	Extreme
12	34.3	71	High	12	37.5	73	Extreme
13	36.0	56	High	13	36.5	78	Extreme
14	36.7	62	Extreme	14	38.2	76	Extreme
15	36.7	64	Extreme	15	37.8	74	Extreme
16	37.2	61	Extreme	16	36.2	73	Extreme
17	37.6	58	Extreme	17	38.0	82	Extreme
18	35	53	Extreme	18	36.0	87	Extreme
19	34.2	67	High	19	36.5	70	Extreme
20	33.4	59	High	20	36.6	81	Extreme
21	35.2	76	Extreme	21	33.6	85	High
22	34.4	80	Extreme	22	34.5	87	Extreme
23	32.6	73	High	23	35.2	93	Extreme
24	34.0	76	High	24	34.0	97	High
25	35.0	89	Extreme	25	35.0	88	Extreme
26	36.0	76	Extreme	26	33.3	93	High
27	37.5	47	Extreme	27	33.4	77	High
28	37.5	56	Extreme	28	33.4	96	High
29	37.4	51	Extreme	29	33.0	79	High
30	37.0	62	Extreme	30	34.0	82	High
31	37.2	67	Extreme	--	--	--	--

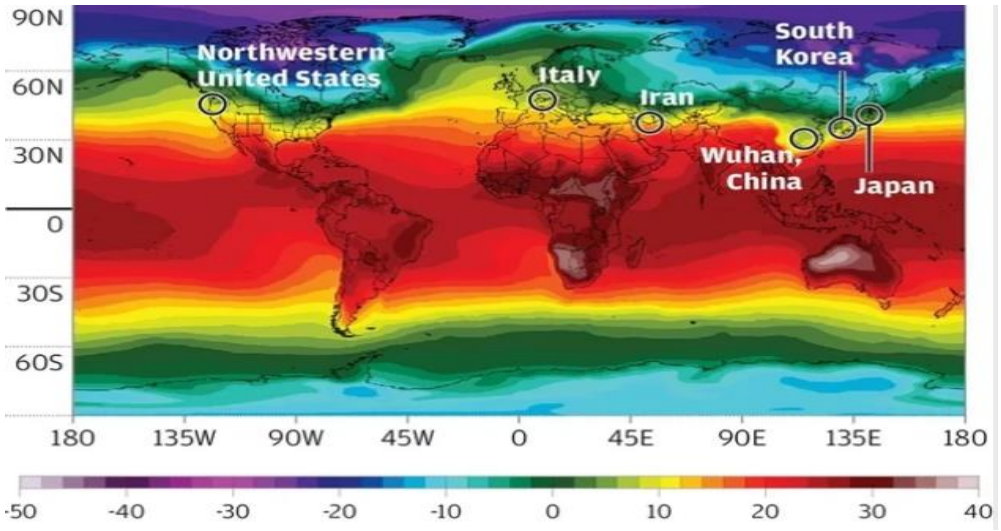

Figure 6: ECMRWF Interim 1000mb average temperature Nov 2019 to April 2020

Table- 4: Maximum Temperature and Humidity in May 2020 in Bangladesh

Date	Temperature (°C)	Humidity	Discomfort from heat
01	33.4	89	Extreme
02	34.0	88	Extreme
03	33.7	84	High
04	36.0	77	Extreme
05	36.2	76	Extreme
06	33.4	94	High
07	36.0	75	Extreme
08	36.0	71	Extreme
09	36.5	70	Extreme
10	37.4	70	Extreme
11	37.5	75	Extreme
12	37.0	69	Extreme
13	37.4	95	Extreme
14	37.2	81	Extreme
15	37.2	91	Extreme
16	37.8	77	Extreme
17	38.0	79	Extreme
18	37.8	70	Extreme
19	37.3	80	Extreme
20	33.2	91	High
21	32.6	88	High
22	34.8	90	Extreme
23	35.8	84	Extreme
24	35.6	81	Extreme
25	34.8	87	Extreme
26	34.6	84	High
27	33.5	98	High
28	31.8	81	High
29	35.4	89	Extreme
30	35.0	90	Extreme
31	35.0	83	Extreme

Figure 7: Corona test line and sample collection in Bangladesh

6. CONCLUSION

Spreading and death rate of corona virus in Bangladesh is comparatively lower than that of Europe, USA, China, India, Malaysia, and Indonesia. Temperature and humidity is the key factor for lower transmission. It is identified that high temperature, favorable humidity and health awareness (mask ware) can significantly reduce the transmission and intensity of novel corona virus. It is observed that novel corona virus stable at low temperature and low humidity environments. Lack of health awareness, lack of mask ware in Bangladesh community spreading increased significantly.

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