Covid-19 FACTORS
Correlated research(2020)

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Introduction:

CORONAVIRUS pandemic has put the world down to its knees. These are one of the most desperate times that the world has seen in decades. People are getting infected, countries are locked down and put into isolation, traveling is being stopped, normal life has been completely halted and there's panic everywhere. At least 114 countries have been affected by this virus so far.

In such a distressing situation where coronavirus has become the epicenter of every person's life, there's a lot of information circulating regarding coronavirus and as a result of which there are many myths in which we all have started to believe in. It's extremely important that we believe only in authentic information and do not trust in unreliable sources because it will only increase the panic.

-In this report I discuss the factors affect on the spread of Covid-19

-To study the relation between the factor and the virus spread I use the concept of correlation coefficient

$$\rho xy = Cov(x,y)/\sigma x \sigma y$$

A) Factors affect Daily cases of Covid-19

1) Curfew & Weather effect on daily new cases in Egypt:

The curfew days begin in 16 March:

The average Weather in Cilisious

	Curfew	Median Temp	Average Weather	Cases
Curfew	1			
Median Temp	0.419928863	1		
Average Weather	0.768195075	0.30746545	1	
Cases	0.851860274	0.285220784	0.659780226	1

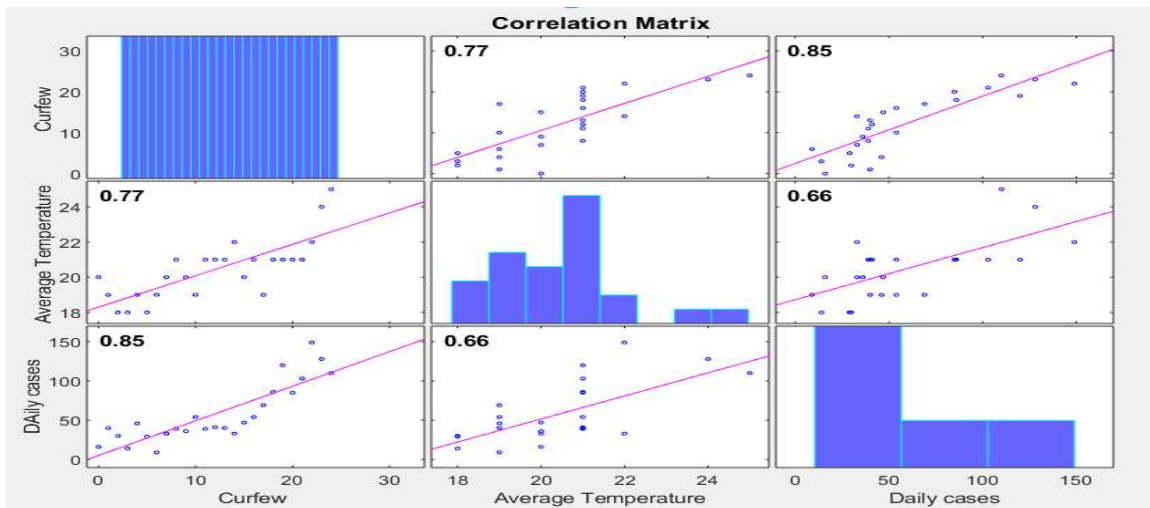## R(Curfew)=0.852

-There is high correlation between daily cases of covid-19 and Curfew .Daily cases strongly affected by Curfew.

R(median Temp)=0.285

R(Weather)=0.66

-There is medium correlation between weather (Temperature &Humidity...) and Daily cases.

2)Daily cases and relative Humidity in Italy :
Correlation using Excel

	% CHANGE IN NO OF REPORTED CASES	% CHANGE IN RELATIVE HUMIDITY
% CHANGE IN NO OF REPORTED CASES	1	
% CHANGE IN RELATIVE HUMIDITY	0.6156711234	1

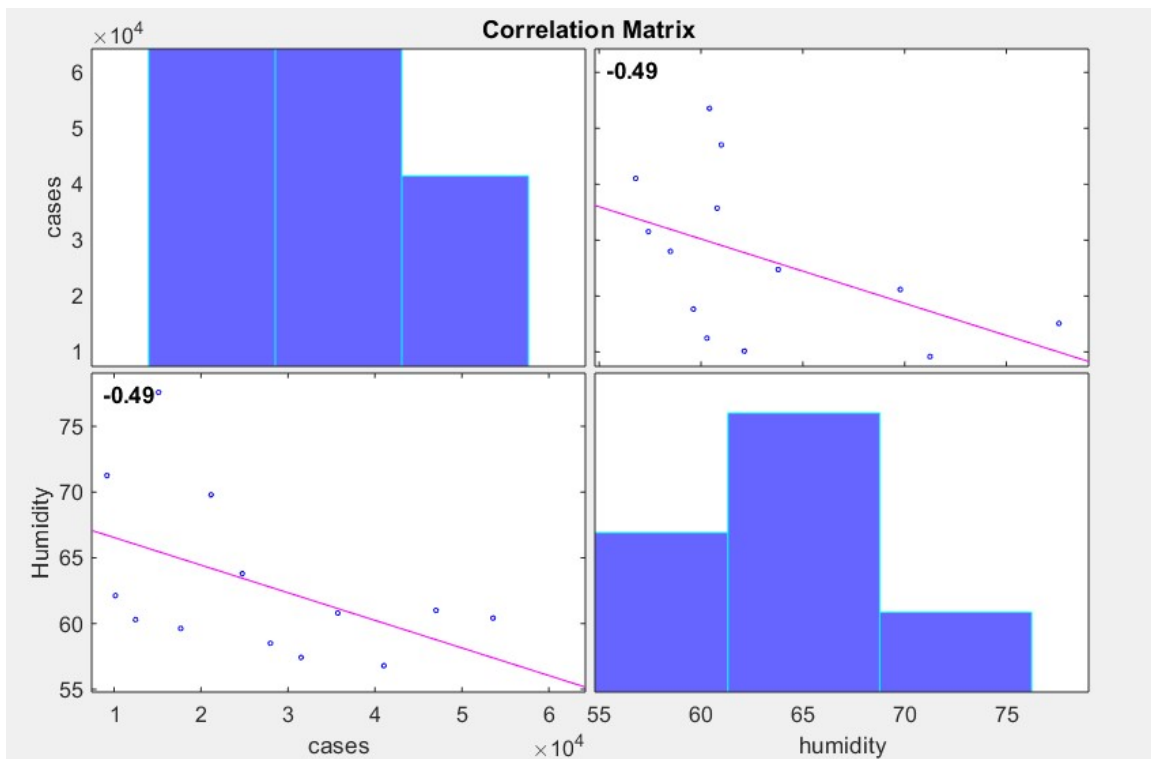**R(change in Humidity and change of daily cases)=0.615**
-there is medium correlation between the change in cases and change in humidity in Italy.

	NO OF REPORTED CASE	RELATIVE HUMIDITY
NO OF REPORTED CASE	1	
RELATIVE HUMIDITY	-0.4915205104	1

R(Humidity and cases)= -0.49

Using MATLAB

B) Factors affect on Total cases of Covid-19

1) Population and cases:

a- Recent data for Covid-19 cases and tests alongside state population size in US states:

Correlation with Excel:

	Population	COVID-19 cases (positive tests)	Tests	Test increase since last week	Deaths from COVID-19 (3-18-20)
Population	1				
COVID-19 cases (positive tests)	0.450141222	1			
Tests	0.668344438	0.395658314	1		
Test increase since last week	0.814458897	0.473518055	0.938933035	1	
Deaths from COVID-19 (3-18-20)	0.353823657	0.256593412	0.879044104	0.74377908	1

R (population & cases) = 0.45 [average correlation]
R (Tests & cases) = 0.3956 [average correlation]
R (Tests & Deaths) = 0.879
R (population & Deaths) = 0.3538
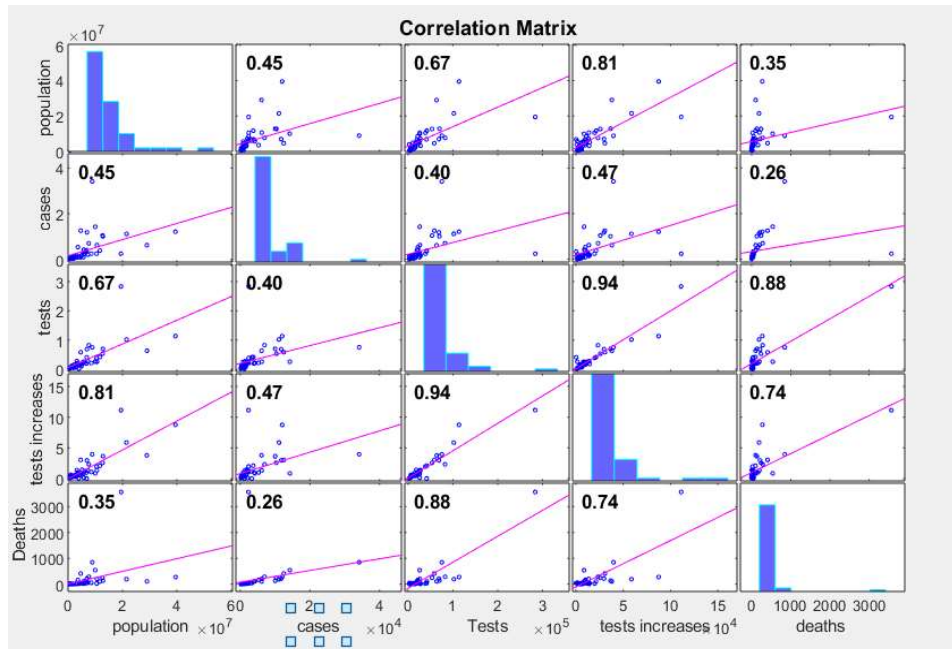
There is medium positive correlation (0.45) between population and cases in states.

-Total cases quite affected by population

b)Ratio of cases, population and affecting population in various countries as a ratio of USA sorted by cases affected ratio

Comparing countries stats in relation to USA				
Country	Total Cases	Cases ratio	Population ratio	Affected ratio
Spain	95,923	0.51	0.14	3.60
Switzerland	16,605	0.09	0.03	3.37
Italy	105,792	0.56	0.18	3.07
Germany	71,808	0.38	0.25	1.50
France	52,128	0.28	0.20	1.40
USA	188,578	1.00	1.00	1.00
Iran	44,605	0.24	0.25	0.93
UK	25,150	0.13	0.25	0.53
China	81,518	0.43	4.35	0.10

	total cases	population	cases ratio	population ratio	affected ratio
total cases	1				
population	0.205077	1			
cases ratio	0.999962	0.2015786	1		
population ratio	0.204921	0.999998	0.201431	1	
affected ratio	-0.0305	-0.54808	-0.02761	-0.547471161	1

R (population & total cases) = 0.205

2)The effect of Weather on the growth rate of COVID-19 :

a)Media temperature and Humidity in different countries:

Country	City used for Temp and Humidity Readings	T, Median Temp (°C) (7 days to 2 March)	H, Median Humidity (%) (7 days to 2 March)	Cases on 3 March 2020	Cases on 7 March 2020	Actual 4 Day Growth Rate (to 7/3/20)	Predicted 4 Day Growth Rate (from Temp & Hum)	% difference of actual 4 day growth rate compared to predicted growth rate	Cases on 4 April 2020 if actual growth rate continued for 28 days
Switzerland	Zurich	5.6	71.4	45	214	4.8 x	5.5 x	14%	11,771,250
UK	London	6.1	75.9	40	164	4.1 x	3.7 x	-11%	3,193,970
Germany	Berlin	5.6	80.1	165	670	4.1 x	4.3 x	6%	12,195,815
France	Paris	6.0	86.3	191	653	3.4 x	3.1 x	-11%	3,565,101
Spain	Madrid	11.6	60.9	120	401	3.3 x	1.6 x	-106%	1,865,891
USA	Seattle	6.9	73.6	99	316	3.2 x	2.8 x	-14%	1,066,720
Iran	Tehran	9.1	64.5	1,501	4,747	3.2 x	2.0 x	-59%	15,020,660
Italy	Milan	8.1	63.9	2,036	4,636	2.3 x	2.4 x	5%	1,471,306
Australia	Sydney	24.7	60.1	33	63	1.9 x	1.2 x	-60%	5,823
Japan	Tokyo	9.0	59.3	274	420	1.5 x	2.1 x	27%	8,351
South Korea	Daegu	7.8	71.2	4,335	6,593	1.5 x	2.3 x	35%	124,091
Bahrain	Manama	21.3	64.1	49	60	1.2 x	1.2 x	1%	248
Singapore	Singapore	29.7	71.4	108	130	1.2 x	1.1 x	-5%	476
Thailand	Bangkok	29.8	75.9	43	48	1.1 x	1.1 x	3%	104
Taiwan	Taipei	22.0	78.9	41	45	1.1 x	1.2 x	9%	86
Hong Kong	Hong Kong	22.5	73.5	100	108	1.1 x	1.2 x	11%	185
Kuwait	Kuwait City	18.9	51.4	56	58	1.0 x	1.3 x	20%	74
China	Wuhan	10.0	80.0	80,026	80,576	1.0 x	1.7 x	40%	84,533

	T media	H	cases (3 March)	cases(7 March)
T media	1			
H	-0.174	1		
cases (3 March)	-0.1374	0.268193	1	
cases(7 March)	-0.159	0.26145	0.998585	1

R(T& cases(3march))= -0.137[negative small correlation]

R(T&Cases(7 march))= -0.159

R(H&cases)= 0.26

-There is small negative correlation between cases and median temperature and positive correlation with humidity.

Correlation Matrix
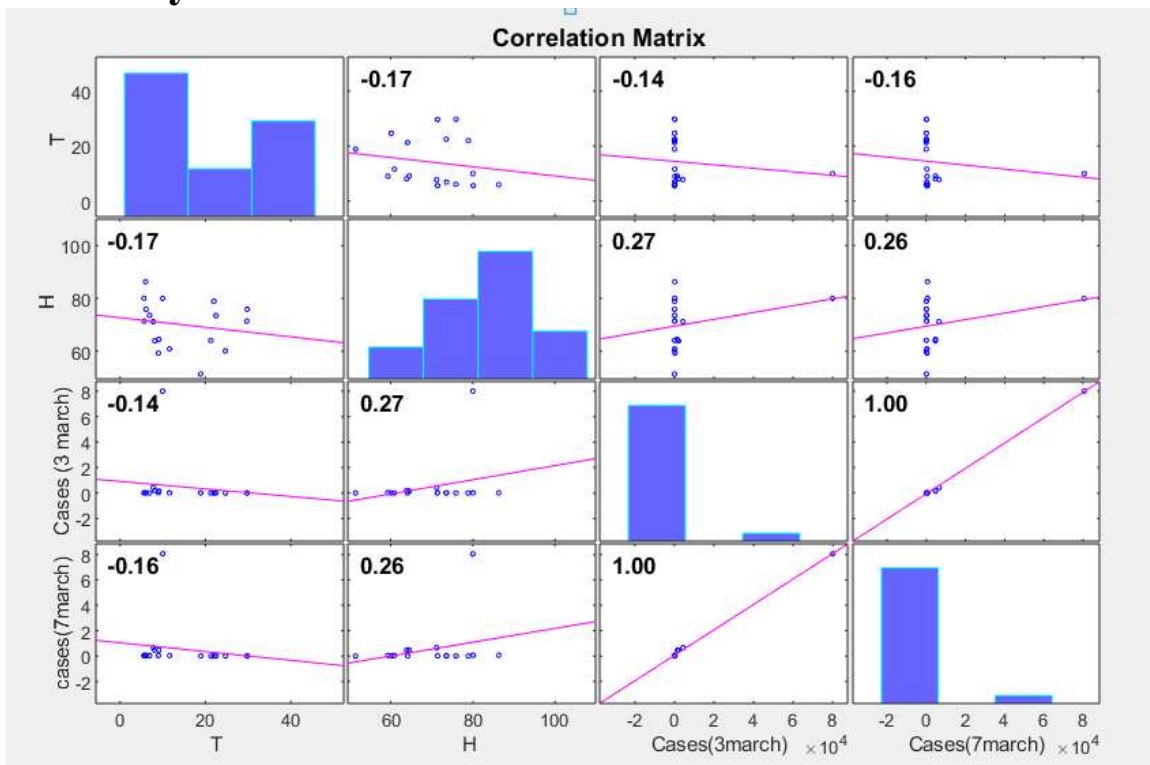
b) Wind & Humidity VS cases in china cities:

Country	Province	Properties							February, 2020			COVID-19	
		Population	Density, Population/km²	Gender Ratio	Average Age	Elevation, m	Max T °C	Min T °C	Average Temperature °C	Humidity %	Wind km/h	Confirmed Cases	Deaths
China	Hubei	59,170,000	318	1.06	38.4	37	15.4	1.4	8.3	77.9	5.4	64786	2563
	Guangdong	113,460,000	630	1.06	38.4	21	21.0	10.3	15.1	76.8	8.2	1347	7
	Henan	96,050,000	575	1.06	38.4	104	13.7	−0.1	6.3	61.9	6.8	1271	19
	Zhejiang	57,370,000	562	1.06	38.4	19	15.1	4.5	9.3	70.1	7.6	1205	1
	Hunan	68,990,000	329	1.06	38.4	63	16.2	4.4	9.6	75.2	8.4	1016	4
	Anhui	63,240,000	454	1.06	38.4	37	14.4	0.1	7.1	76.9	9.6	989	6
	Jiangxi	46,480,000	278	1.06	38.4	37	16.6	5.9	10.5	73.4	5.3	934	1
	Shandong	100,470,000	653	1.06	38.4	23	11.6	0.2	5.4	56.0	8.3	755	6
	Jiangsu	80,510,000	785	1.06	38.4	15	14.2	2.4	7.8	73.0	9.0	631	0
	Chongqing	31,020,000	377	1.06	38.4	244	14.3	8.0	10.7	78.3	3.4	576	6
	Sichuan	83,410,000	172	1.06	38.4	500	14.9	5.4	9.75	65.50	6.10	529	3
	Heilongjiang	37,730,000	83	1.06	38.4	126	−5.8	−20.6	−12.7	69.9	9.9	480	12
	Beijing	21,540,000	1313	1.06	38.4	43.5	7.8	−4.8	1.0	55.7	7.2	400	4
	Shanghai	24,240,000	3823	1.06	38.4	4	14.1	2.4	8.1	72.8	9.1	335	3
	Hebei	75,560,000	403	1.06	38.4	83	10.6	−1.5	4.1	54.6	8.5	311	6
	Fujian	39,410,000	324	1.06	38.4	14	18.4	8.3	12.7	70.6	7.4	294	1
	Guangxi	49,260,000	209	1.06	38.4	499	20.4	11.5	15.5	74.4	9.6	252	2
	Shaanxi	38,640,000	247	1.06	38.4	405	14.5	2.3	7.8	62.4	3.9	245	1
	Yunnan	48,300,000	123	1.06	38.4	1892	18.0	3.4	10.6	64.1	9.0	174	2
	Hainan	9,340,000	275	1.06	38.4	222	24.5	16.8	19.9	81.1	11.3	168	5
	Guizhou	36,000,000	205	1.06	38.4	1275	12.5	3.9	7.6	82.0	8.5	146	2
	Tianjin	15,600,000	1380	1.06	38.4	1078	8.6	−4.0	1.8	61.8	9.3	135	3
	Shanxi	37,180,000	181	1.06	38.4	800	10.0	−7.1	0.6	52.6	7.0	133	0
	Liaoning	43,590,000	299	1.06	38.4	55	2.0	−12.6	−5.36	64.22	8.26	121	1
	Jilin	27,040,000	2704	1.06	38.4	202	−2.4	−15.7	−8.96	66.52	9.60	93	1

Correlation using Excel:

	confirmed cases	population Density	gender ratio	Average age	Elevation	T average	Humidity	wind	deaths
confirmed cases	1								
population Dens	-0.089170192	1							
gender ratio	-6.0638E-17	2.15683E-17	1						
Average age	-6.0638E-17	2.15683E-17	1	1					
Elevation	-0.134877571	-0.181719991	-6.33907E-17	-6.33907E-17	1				
T average	0.904409933	-0.176095432	7.6817E-17	7.6817E-17	-0.08466	1			
Humidity	0.230046333	-0.060878495	2.30505E-15	2.30505E-15	-0.10323	0.3987	1		
wind	-0.275841759	0.240258271	-7.43929E-16	-7.43929E-16	0.10743	-0.292	0.1029	1	
deaths	0.999612646	-0.085516937	2.04034E-17	2.04034E-17	-0.12219	0.9008	0.2234	-0.27	1

R(humidity) = 0.23[small correlation]

R(wind)= -0.275 [quite Small negative correlation]

3) -Unemployment Rate
   -Smokers Rate
   -Health care index
   -GDP per capita

	unemployment %	SMOKERS %	Health care index	GDP per capita	Total cases
unemployment %	1				
SMOKERS %	0.310436407	1			
Health care index	-0.113060888	-0.275526227	1		
GDP per capita	-0.308155254	-0.678567208	0.65206684	1	
Total cases	0.316086716	0.10758769	0.509956578	0.258039525	1

R(Unemployment%)=0.316[Medium positive correlation]

R(smokers)=0.1076 [small correlation]

R(Health care index)=0.51[medium correlation]

R(GDP)=0.258

Correlation Matrix
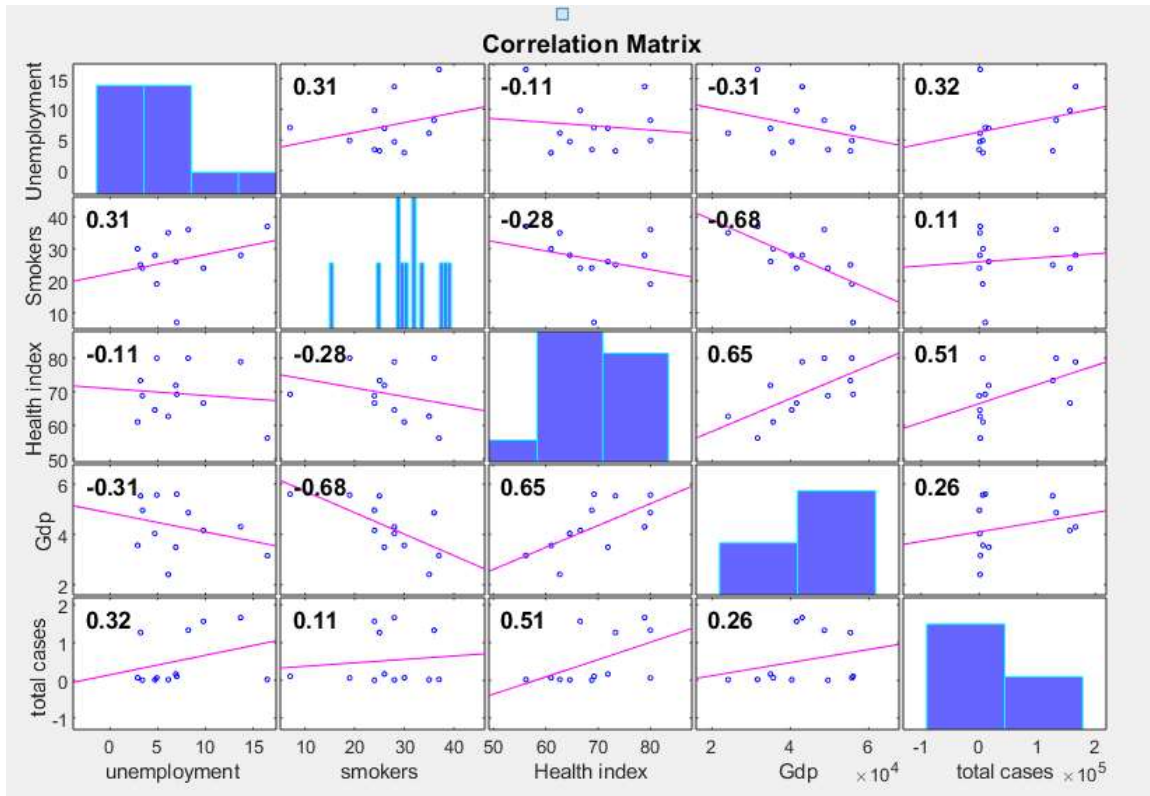
4)Other Factors affect on Coronavirus Cases:

-Air pollution Normalized
-Median Temperature
-Percent_High_Blood_pressure
-Diabetes_prevalence
-Total Trade
-Nursing personnel Total
-State Emergency Provisions
-Population 65+

Correlation using Excel:

Column1	total cases	ir_Pollu	dian_Temp_Jan	ent_High_Blood_P	betes_Preva	al Trade (Exp+	sing personne	of Emergency Pro	+(normal	rcent sm	spital beds p	oal Doc
total cases	1											
Air_Pollution	-0.316909928	1										
Median_Temp_Jan_2020	-0.243330468	-0.4905	1									
Percent_High_Blood_Pressure	-0.561051901	0.2673	0.338660416	1								
Diabetes_Prevalence	0.460315036	0.349	-0.593691325	-0.235815694	1							
Total Trade (Exp+Imp)	0.546731185	0.2654	-0.842689996	-0.375562504	0.60894722	1						
Nursing personnel total	0.518438783	0.4103	-0.875606061	-0.398474861	0.57803157	0.966848121	1					
State of Emergency Provisions	0.61184155	-0.3676	-0.243074114	-0.470642804	0.08772629	0.19197683	0.188612602	1				
65+(normalized)	0.160943073	-0.799	0.267687443	-0.04424324	-0.4738374	0.00199267	-0.15655245	0.264683608	1			
percent smoker	-0.020935669	-0.4177	0.043129647	0.303860891	-0.2558851	0.194464383	0.059871954	-0.147186826	0.776455	1		
Hospital beds per 10k	-0.160067643	-0.2384	-0.156222374	0.397412593	0.05622446	0.247662425	0.056167136	-0.203498243	0.493817	0.77034	1	
Toal Doctors	0.137650098	0.6951	-0.815895809	-0.10299895	0.40941639	0.80717252	0.888766677	-0.072303202	-0.28789	0.05795	0.01208528	1

R(air pollution normalized)=-0.317

R(median temp)=-0.243
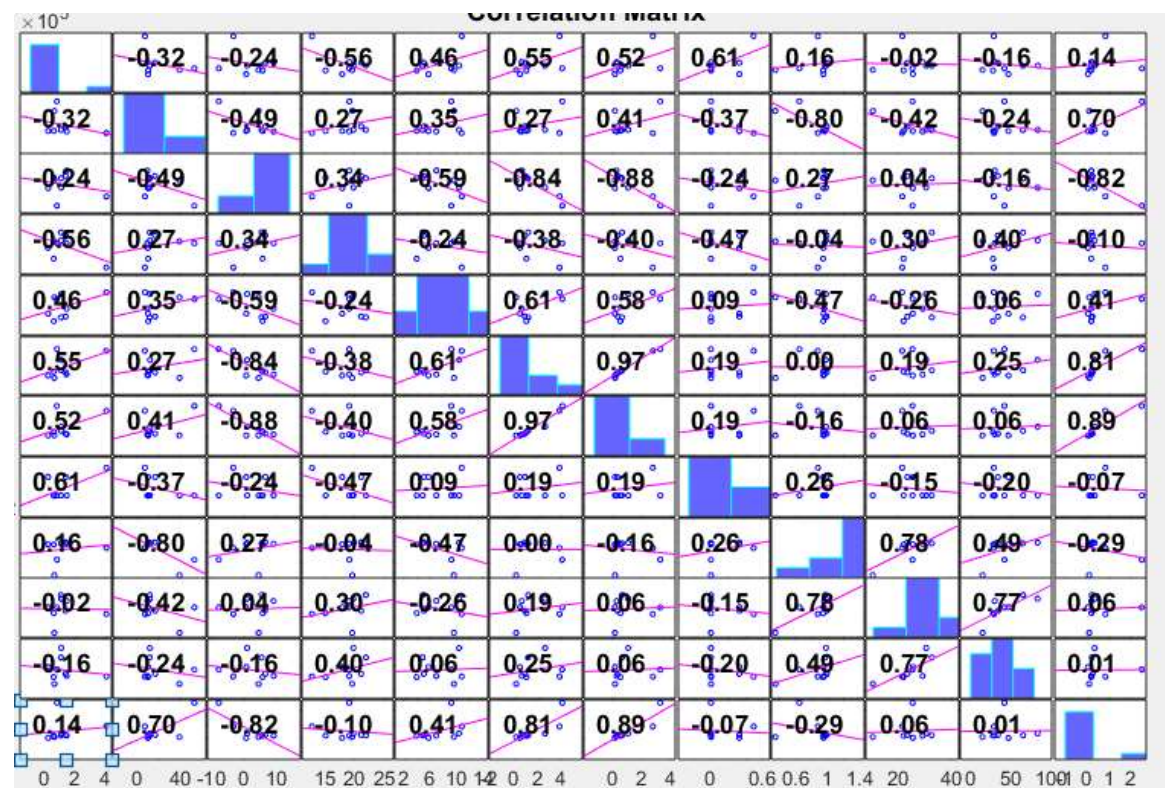
R(percent high blood pressure)=-0.561
R(diabetes prevalence)=0.4603
R(total trade)=0.5467
R(nursing personal total)=0.5184
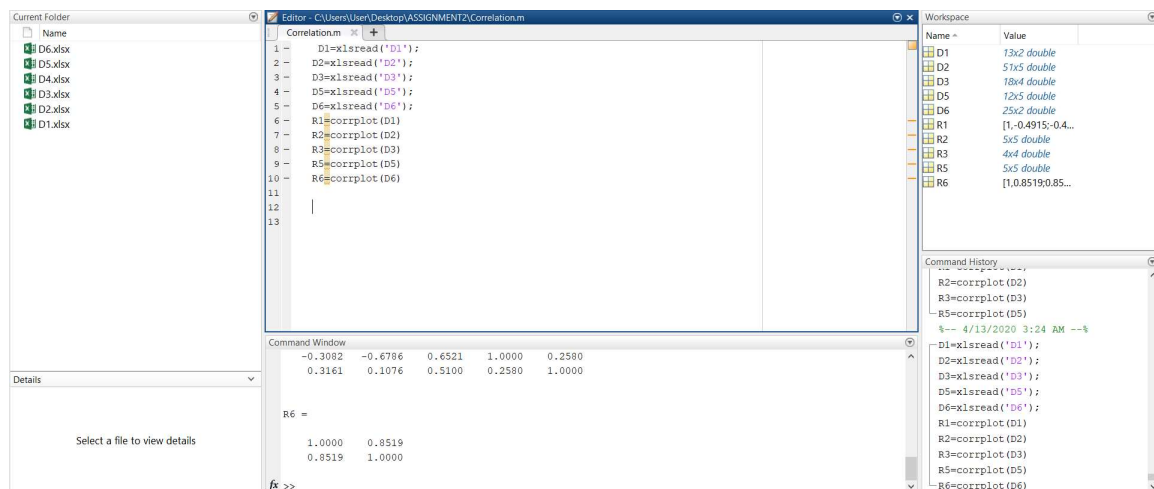R(state of emergency provisions)=0.6118
R(65+ population)=0.161

Correlation Matrix

Conclusion:

The growth of Coronavirus Strongly affected by Curfew and small affected by weather and medium affected by some factors as population , unemployment …

MATLAB CODE

Reference:

https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Egypt

https://www.holiday-weather.com/cairo/2020/april

https://www.numbeo.com/health-care/rankings_by_country.jsp

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https://hackernoon.com/covid-19-analysing-the-spread-across-populations-8f8t32br?source=rss

https://www.researchgate.net/publication/339887331_Analysis_and_forecast_of_COVID-19_spreading_in_China_Italy_and_France