

Covid-19 in Rural Illinois Counties: Disease Progression, and Health Care System Correlates

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The Covid-19 outbreak is likely to grow, mature, and decline. Governments at all levels should aim to (1) **FLATTEN** the growth curve, and (2) collectively **FIGHT** the virus, to preserve public health, and reopen the economy.

To gain insights into the status of the disease in Illinois counties, it is suggested that a set of metrics be assembled on a weekly basis and presented visually and in tabular forms to policymakers². The metrics, assembled at the county-level, should include daily growth rate of total cases, cumulative number of confirmed cases, number of Covid-19 tests performed, and correlates of daily growth rate of infections and healthcare assets such as number of physicians and intensive-care-unit (ICU) beds.

To restart the Illinois economy, Illinoisans' sentiments about the virus should also be monitored on a continual basis, once a week or so. This will help policymakers learn about Illinoisans' anticipated consumer behavior and spending.

In the following pages, these metrics are compiled for rural Illinois³ and presented as an illustration of the proposed work⁴. The Covid-19 cases are as at April 15, 2020.

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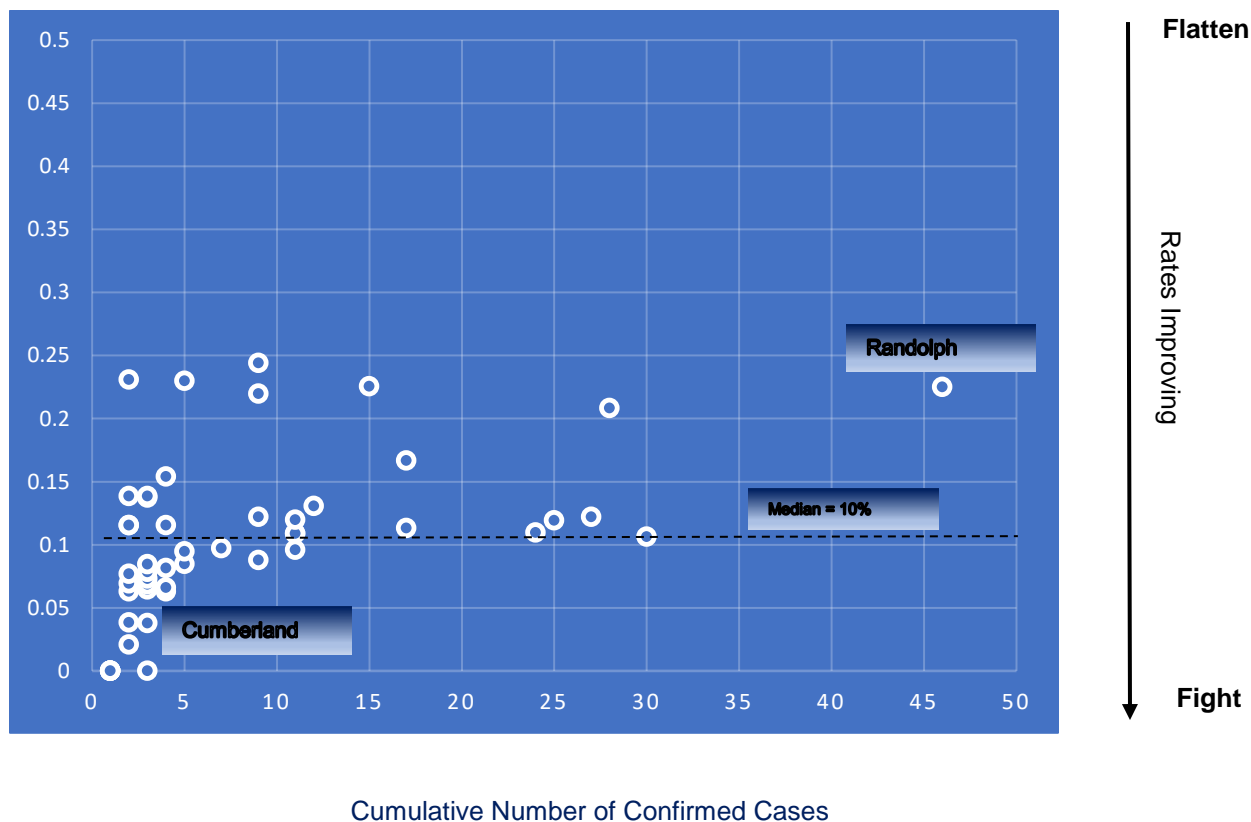
² The Illinois Institute for Rural Affairs (IIRA) at Western Illinois University has produced a series of such publications; see <http://www.iira.org/2020-2021-publications/>

³ Rural geography is based on rural-urban continuum codes; see <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx>. Fifty counties are categorized as rural.

⁴ This paper was initially prepared as a research proposal for Illinois policymakers to inform them about metrics related to Covid-19.

Disease Progression in Rural Illinois Counties as at April 15, 2020

Daily Growth Rate of Total Cases



These counties have to control disease progression, **flatten the curve**; their daily growth rates of the disease are above the median for the rural region, and the counties have had the virus for more days than the median 16 days for rural Illinois: Randolph, Adams, Christian, LaSalle, and Fayette (see Table 1 for the full list of counties in the group).

These counties are approaching the **fight stage**; their daily growth rates of the disease are below the median for the rural region, and the counties have had the virus for more days than the median 16 days for rural Illinois: Cumberland, Washington, Logan, Franklin, and Stephenson (see Table 1 for the full list of counties in the group).

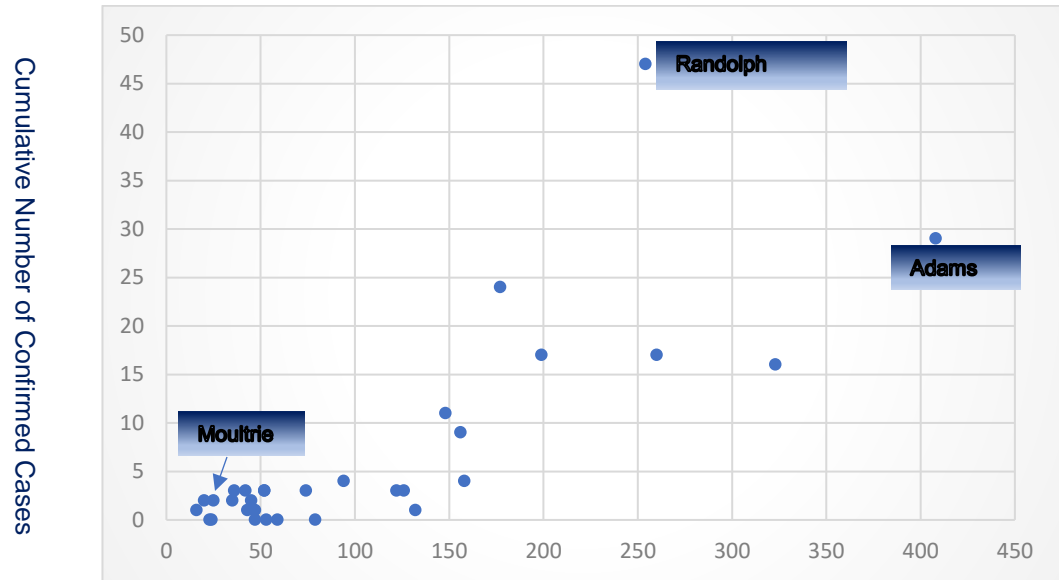
Table 1: Covid-19 in Illinois Counties as at April 15, 2020: Phase of the Disease

Phase: **FIGHT**

Phase: **FLATTEN**

County	# of Cases	# of Deaths	No. of Days	Growth	Cases/Day	County	# of Cases	# of Deaths	No. of Days	Growth	Cases/Day
Clay	1	0	2	~0	0.5	Douglas	11	0	22	0.10899524	0.5
Perry	1	0	5	~0	0.2	Morgan	11	1	22	0.10899524	0.5
Pike	1	0	12	~0	0.08	LaSalle	24	2	29	0.109588063	0.827586207
Richland	1	0	9	~0	0.11	Livingston	17	0	25	0.113328534	0.68
Schuyler	1	0	7	~0	0.14	Fulton	2	0	6	0.11552453	0.333333333
Cumberland	2	0	33	0.02100446	0.06	Greene	2	0	6	0.11552453	0.333333333
Washington	3	0	29	0.037883182	0.103448276	Jasper	4	1	12	0.11552453	0.333333333
Knox	2	0	18	0.038508177	0.111111111	Christian	25	5	27	0.119217623	0.925925926
Gallatin	2	0	11	0.06301338	0.181818182	Iroquois	11	0	20	0.119894764	0.55
Logan	4	0	22	0.06301338	0.181818182	Adams	27	0	27	0.122068032	1
Saline	3	0	17	0.064624252	0.176470588	Montgomery	9	1	18	0.122068032	0.5
Franklin	4	0	21	0.066014017	0.19047619	Fayette	12	2	19	0.130784561	0.631578947
Mason	3	0	16	0.068663268	0.1875	Hancock	3	0	8	0.137326536	0.375
Wabash	2	0	10	0.069314718	0.2	McDonough	2	0	5	0.138629436	0.4
Massac	3	0	15	0.073240819	0.2	Warren	2	0	5	0.138629436	0.4
Lawrence	2	0	9	0.077016353	0.222222222	Shelby	4	0	9	0.154032707	0.444444444
Moultrie	3	0	14	0.078472306	0.214285714	Marion	17	0	17	0.166659608	1
Clark	4	0	17	0.081546727	0.235294118	Ogle	28	1	16	0.208262782	1.75
Effingham	3	1	13	0.084508638	0.230769231	Jefferson	9	0	10	0.219722458	0.9
Carroll	5	1	19	0.084707259	0.263157895	Randolph	46	0	17	0.2252142	2.705882353
Stephenson	9	0	25	0.087888983	0.36	Lee	15	0	12	0.22567085	1.25
Crawford	5	0	17	0.094672818	0.294117647	Pulaski	5	0	7	0.229919702	0.714285714
Jo Daviess	11	0	25	0.095915811	0.44	Johnson	2	0	3	0.23104906	0.666666667
Bureau	7	0	20	0.097295507	0.35	Coles	9	0	9	0.244136064	1
Whiteside	30	3	32	0.106287418	0.9375	Union	3	0	1	NA	3

Testing and Disease Progression



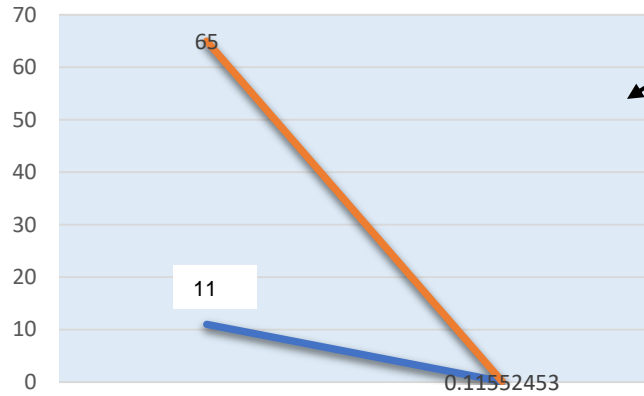
Total Number of Tests Performed as at April 16, 2020

Counties with high GDP are testing more and have a higher number of Covid-19 infections, the correlation is 0.79ⁱ; see the Table below for examples.

Rural County	No. of Tests Performed as at 4/16/20 ⁱⁱ	Positive cases	Real GDP
Adams	408	29	\$ 3,284,870,000.00
Knox	126	3	\$ 1,750,984,000.00
Lee	323	16	\$ 1,508,358,000.00
Livingston	199	17	\$ 1,753,899,000.00
Logan	158	4	\$ 1,110,851,000.00
Moultrie	35	2	\$ 692,823,000

Correlation Between Healthcare Structures and Daily Growth Rate of Covid-19 Infections

More Physicians, More Cases



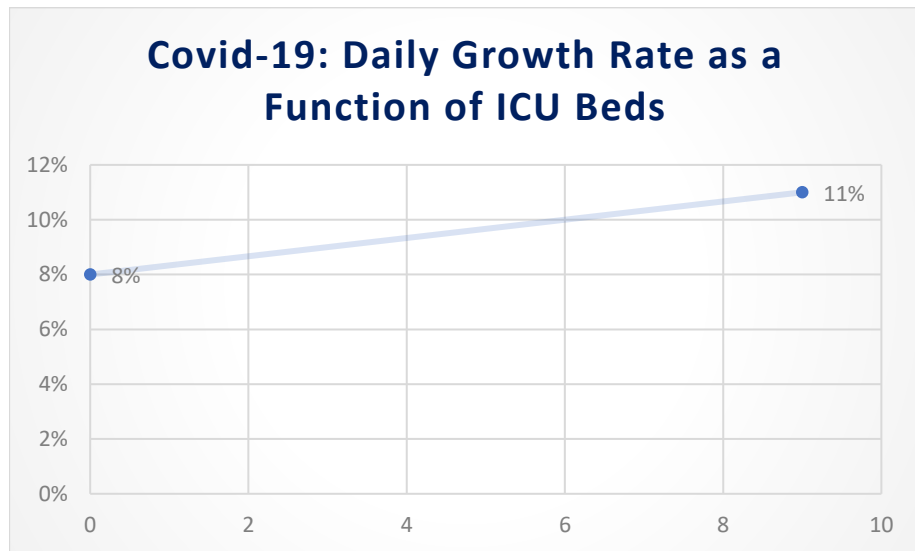
Average # of Physicians	Daily Growth Rate
11	0.084508638
65	0.11552453

There are twenty-five counties each averaging 11 physicians; these counties average 8% growth in Covid-19 infections per day; the remaining 25 counties each has an average of 65 physicians and they register a 12% growth rate in Coronavirus infections, per day.

Average # of ICU Beds	Daily Growth Rate
Approx. 0	8%
9	11%

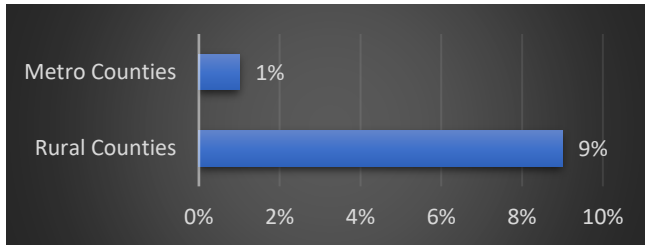
For the twenty-five counties each with little or no ICU beds; Covid-19 infections grow at 8% per-day; the remaining 25 counties each has an average of nine ICU beds and they register a 11% growth rate in Coronavirus infections, per day.

Covid-19: Daily Growth Rate as a Function of ICU Beds



Illinoisans' Sentiments about Covid-19

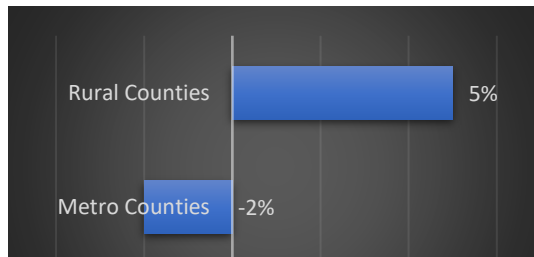
Emotions Associated with Covid-19



Wave 1 (March 21, 2020 to April 5, 2020)

Majority of the tweets about Covid-19 were either neutral or positive. This is a good situation for Illinois, neutral to positive emotions among the general public signal that they are relaxed or relieved that the virus situation is not out of control and/or it can be managed.

Emotions Associated with Covid-19



Wave 2 (April 6, 2020 to April 15, 2020)

Majority of the tweets about Covid-19 were positive for rural Illinois, but metro residents feel bad about the virus situation. Overall, Illinoisans' feel less relaxed about Covid-19 than they were two weeks ago.

Summary and Conclusion

Even as Covid-19 continues to spread throughout Illinois, the signs of recovery are being seen in some rural counties such as Cumberland, and Washington (see Table 1). These counties need to FIGHT, put in place strategies to maintain the decline in daily growth rate of the virus. Some of these strategies include continuing with restrictions such as internal movement of population, and school and workplace closing.

Counties that are yet to FLATTEN the growth curve (Table 1) need to continue with closing public transportation, and canceling public events. In addition, public information campaigns should be carried out to inform residents about the need for social distancing, etc.

Our research highlights the relationship between growth rate of Covid-19 infections and healthcare industry structure; for example, the higher the number of physicians in the county, the higher the number of Covid-19 tests and diagnoses. In general, the higher the GDP of the county, the higher is the number of people tested for the virus.

The implication for fighting the virus is clear, invest in healthcare, rural Illinois needs more healthcare professionals and ICU beds. Since county GDP is correlated with healthcare provision, economic development of rural regions should be the primary focus for policymakers. Towards this end, IIRA is continually monitoring the effects of Covid-19, and through a series of publications is keeping economic developers informed of the impact of the virus on the rural regions.

ⁱ A correlation of 0.79 suggests that approximately 64% of the variance in Covid-19 testing can be attributed to the wealth of the county as measured by its GDP. The GDP data given in the table are real, 2012 \$.

ⁱⁱ Data were sourced from county health departments, see <http://www.idph.state.il.us/local/alpha.htm>.