

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/2/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 2/2/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

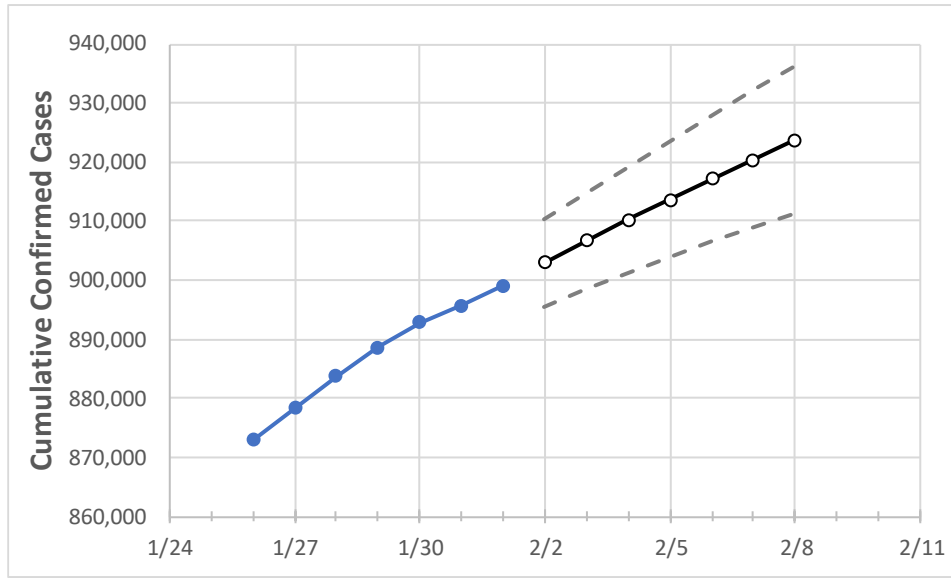
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Ohio State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Ohio	888,590	892,781	895,792	899,079	902,945	906,709	910,242	913,691	917,119	920,414	923,674	

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Athens	3,981	4,013	4,027	4,060	4,089	4,116	4,144	4,172	4,199	4,227	4,253	
Cuyahoga	88,344	88,752	89,042	89,371	89,736	90,089	90,434	90,767	91,078	91,378	91,671	
Franklin	104,034	104,449	104,761	105,102	105,482	105,848	106,190	106,540	106,857	107,171	107,465	
Hamilton	66,481	66,862	67,154	67,394	67,736	68,068	68,397	68,717	69,027	69,331	69,623	
Lake	16,675	16,745	16,807	16,867	16,945	17,018	17,088	17,156	17,221	17,286	17,348	
Lorain	19,830	19,927	20,012	20,107	20,217	20,323	20,428	20,526	20,625	20,724	20,818	
Lucas	32,356	32,531	32,637	32,747	32,882	33,014	33,148	33,275	33,403	33,526	33,644	
Mahoning	17,861	17,953	17,999	18,058	18,134	18,207	18,279	18,349	18,417	18,485	18,551	
Medina	12,027	12,096	12,138	12,189	12,247	12,303	12,357	12,410	12,462	12,511	12,561	
Miami	9,386	9,430	9,468	9,489	9,520	9,550	9,579	9,606	9,633	9,659	9,683	
Summit	36,041	36,245	36,414	36,541	36,703	36,861	37,011	37,159	37,303	37,444	37,579	

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Ohio Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	1/29	1/30	1/31	2/1	2/3				2/5				2/7			
Athens	3,981	4,013	4,027	4,060	4,116	(823)	[198]	{99}	4,172	(834)	[200]	{100}	4,227	(845)	[203]	{101}
Cuyahoga	88,344	88,752	89,042	89,371	90,089	(18,018)	[4,324]	{2,162}	90,767	(18,153)	[4,357]	{2,178}	91,378	(18,276)	[4,386]	{2,193}
Franklin	104,034	104,449	104,761	105,102	105,848	(21,170)	[5,081]	{2,540}	106,540	(21,308)	[5,114]	{2,557}	107,171	(21,434)	[5,144]	{2,572}
Hamilton	66,481	66,862	67,154	67,394	68,068	(13,614)	[3,267]	{1,634}	68,717	(13,743)	[3,298]	{1,649}	69,331	(13,866)	[3,328]	{1,664}
Lake	16,675	16,745	16,807	16,867	17,018	(3,404)	[817]	{408}	17,156	(3,431)	[823]	{412}	17,286	(3,457)	[830]	{415}
Lorain	19,830	19,927	20,012	20,107	20,323	(4,065)	[976]	{488}	20,526	(4,105)	[985]	{493}	20,724	(4,145)	[995]	{497}
Lucas	32,356	32,531	32,637	32,747	33,014	(6,603)	[1,585]	{792}	33,275	(6,655)	[1,597]	{799}	33,526	(6,705)	[1,609]	{805}
Mahoning	17,861	17,953	17,999	18,058	18,207	(3,641)	[874]	{437}	18,349	(3,670)	[881]	{440}	18,485	(3,697)	[887]	{444}
Medina	12,027	12,096	12,138	12,189	12,303	(2,461)	[591]	{295}	12,410	(2,482)	[596]	{298}	12,511	(2,502)	[601]	{300}
Miami	9,386	9,430	9,468	9,489	9,550	(1,910)	[458]	{229}	9,606	(1,921)	[461]	{231}	9,659	(1,932)	[464]	{232}
Summit	36,041	36,245	36,414	36,541	36,861	(7,372)	[1,769]	{885}	37,159	(7,432)	[1,784]	{892}	37,444	(7,489)	[1,797]	{899}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.