

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

Date: 1/6/21

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 1/6/21 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.

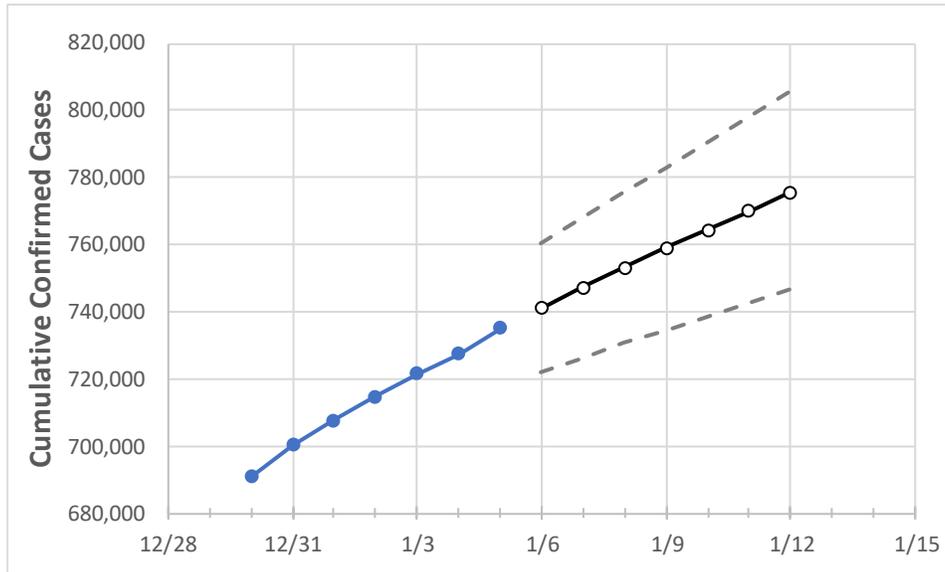
IEM's Modeling Lead

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:							
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	
Ohio	714,673	721,481	727,423	735,003	741,139	747,160	753,125	759,018	764,525	770,076	775,633	

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:							
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	
Athens	3,146	3,171	3,190	3,229	3,252	3,276	3,299	3,321	3,344	3,367	3,389	
Cuyahoga	71,742	72,520	73,116	73,664	74,297	74,924	75,545	76,150	76,762	77,366	77,954	
Franklin	85,553	86,446	87,106	87,784	88,460	89,124	89,785	90,437	91,093	91,735	92,375	
Hamilton	52,847	53,404	53,797	54,379	54,821	55,254	55,696	56,131	56,554	56,985	57,401	
Lake	13,013	13,156	13,317	13,478	13,617	13,753	13,887	14,021	14,158	14,291	14,427	
Lorain	15,231	15,421	15,622	15,790	15,971	16,152	16,335	16,517	16,698	16,874	17,055	
Lucas	26,344	26,509	26,742	26,934	27,139	27,340	27,541	27,738	27,930	28,120	28,303	
Mahoning	15,047	15,131	15,269	15,399	15,517	15,628	15,738	15,845	15,949	16,052	16,154	
Medina	9,515	9,601	9,700	9,830	9,921	10,014	10,106	10,197	10,288	10,377	10,463	
Miami	7,773	7,841	7,872	7,960	8,026	8,091	8,155	8,216	8,280	8,344	8,406	
Summit	28,539	28,782	29,030	29,361	29,608	29,847	30,083	30,321	30,550	30,777	30,994	

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:											
	1/2	1/3	1/4	1/5	1/7			1/9			1/11					
Athens	3,146	3,171	3,190	3,229	3,276	(655)	[157]	{79}	3,321	(664)	[159]	{80}	3,367	(673)	[162]	{81}
Cuyahoga	71,742	72,520	73,116	73,664	74,924	(14,985)	[3,596]	{1,798}	76,150	(15,230)	[3,655]	{1,828}	77,366	(15,473)	[3,714]	{1,857}
Franklin	85,553	86,446	87,106	87,784	89,124	(17,825)	[4,278]	{2,139}	90,437	(18,087)	[4,341]	{2,170}	91,735	(18,347)	[4,403]	{2,202}
Hamilton	52,847	53,404	53,797	54,379	55,254	(11,051)	[2,652]	{1,326}	56,131	(11,226)	[2,694]	{1,347}	56,985	(11,397)	[2,735]	{1,368}
Lake	13,013	13,156	13,317	13,478	13,753	(2,751)	[660]	{330}	14,021	(2,804)	[673]	{337}	14,291	(2,858)	[686]	{343}
Lorain	15,231	15,421	15,622	15,790	16,152	(3,230)	[775]	{388}	16,517	(3,303)	[793]	{396}	16,874	(3,375)	[810]	{405}
Lucas	26,344	26,509	26,742	26,934	27,340	(5,468)	[1,312]	{656}	27,738	(5,548)	[1,331]	{666}	28,120	(5,624)	[1,350]	{675}
Mahoning	15,047	15,131	15,269	15,399	15,628	(3,126)	[750]	{375}	15,845	(3,169)	[761]	{380}	16,052	(3,210)	[771]	{385}
Medina	9,515	9,601	9,700	9,830	10,014	(2,003)	[481]	{240}	10,197	(2,039)	[489]	{245}	10,377	(2,075)	[498]	{249}
Miami	7,773	7,841	7,872	7,960	8,091	(1,618)	[388]	{194}	8,216	(1,643)	[394]	{197}	8,344	(1,669)	[401]	{200}
Summit	28,539	28,782	29,030	29,361	29,847	(5,969)	[1,433]	{716}	30,321	(6,064)	[1,455]	{728}	30,777	(6,155)	[1,477]	{739}

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.