

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

Date: 1/4/21

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 1/4/21 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.

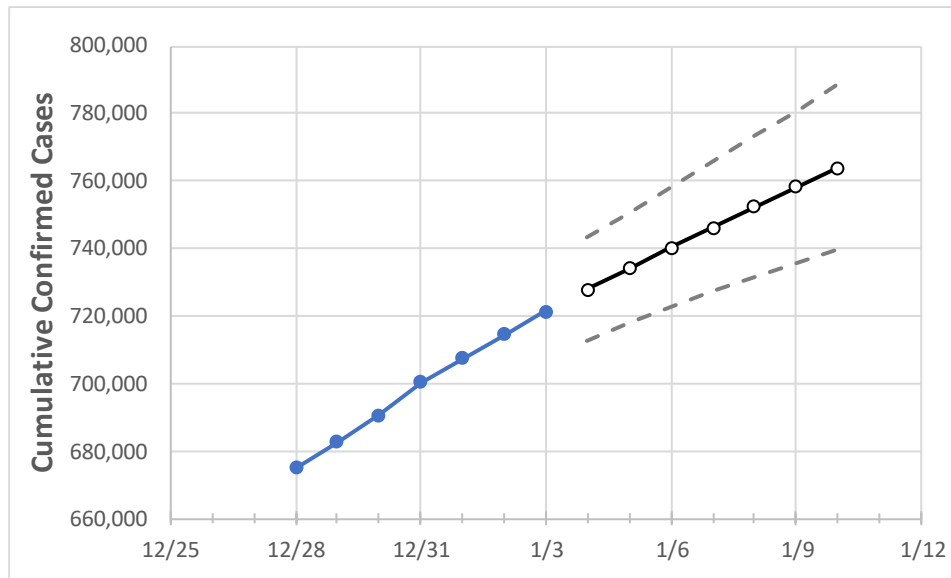
IEM's Modeling Lead

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:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Ohio	700,380	707,527	714,673	721,481	727,816	733,946	740,221	746,277	752,288	758,165	763,783

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:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Athens	3,101	3,124	3,146	3,171	3,193	3,214	3,236	3,257	3,279	3,299	3,320
Cuyahoga	70,137	70,940	71,742	72,520	73,185	73,833	74,488	75,110	75,735	76,349	76,951
Franklin	84,050	84,802	85,553	86,446	87,152	87,848	88,535	89,225	89,900	90,581	91,239
Hamilton	51,821	52,334	52,847	53,404	53,852	54,289	54,728	55,165	55,595	56,023	56,458
Lake	12,756	12,885	13,013	13,156	13,289	13,416	13,545	13,667	13,792	13,917	14,035
Lorain	14,786	15,009	15,231	15,421	15,595	15,769	15,939	16,109	16,284	16,456	16,632
Lucas	25,805	26,075	26,344	26,509	26,720	26,930	27,133	27,339	27,538	27,734	27,927
Mahoning	14,800	14,924	15,047	15,131	15,256	15,376	15,493	15,609	15,723	15,831	15,939
Medina	9,312	9,414	9,515	9,601	9,688	9,773	9,858	9,941	10,023	10,103	10,182
Miami	7,580	7,677	7,773	7,841	7,911	7,983	8,055	8,124	8,194	8,264	8,334
Summit	28,040	28,290	28,539	28,782	29,029	29,260	29,497	29,735	29,954	30,166	30,380

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:											
	12/31	1/1	1/2	1/3	1/5				1/7				1/9			
Athens	3,101	3,124	3,146	3,171	3,214	(643)	[154]	{77}	3,257	(651)	[156]	{78}	3,299	(660)	[158]	{79}
Cuyahoga	70,137	70,940	71,742	72,520	73,833	(14,767)	[3,544]	{1,772}	75,110	(15,022)	[3,605]	{1,803}	76,349	(15,270)	[3,665]	{1,832}
Franklin	84,050	84,802	85,553	86,446	87,848	(17,570)	[4,217]	{2,108}	89,225	(17,845)	[4,283]	{2,141}	90,581	(18,116)	[4,348]	{2,174}
Hamilton	51,821	52,334	52,847	53,404	54,289	(10,858)	[2,606]	{1,303}	55,165	(11,033)	[2,648]	{1,324}	56,023	(11,205)	[2,689]	{1,345}
Lake	12,756	12,885	13,013	13,156	13,416	(2,683)	[644]	{322}	13,667	(2,733)	[656]	{328}	13,917	(2,783)	[668]	{334}
Lorain	14,786	15,009	15,231	15,421	15,769	(3,154)	[757]	{378}	16,109	(3,222)	[773]	{387}	16,456	(3,291)	[790]	{395}
Lucas	25,805	26,075	26,344	26,509	26,930	(5,386)	[1,293]	{646}	27,339	(5,468)	[1,312]	{656}	27,734	(5,547)	[1,331]	{666}
Mahoning	14,800	14,924	15,047	15,131	15,376	(3,075)	[738]	{369}	15,609	(3,122)	[749]	{375}	15,831	(3,166)	[760]	{380}
Medina	9,312	9,414	9,515	9,601	9,773	(1,955)	[469]	{235}	9,941	(1,988)	[477]	{239}	10,103	(2,021)	[485]	{242}
Miami	7,580	7,677	7,773	7,841	7,983	(1,597)	[383]	{192}	8,124	(1,625)	[390]	{195}	8,264	(1,653)	[397]	{198}
Summit	28,040	28,290	28,539	28,782	29,260	(5,852)	[1,404]	{702}	29,735	(5,947)	[1,427]	{714}	30,166	(6,033)	[1,448]	{724}

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.