

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

Date: 5/24/21

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 5/24/21 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.

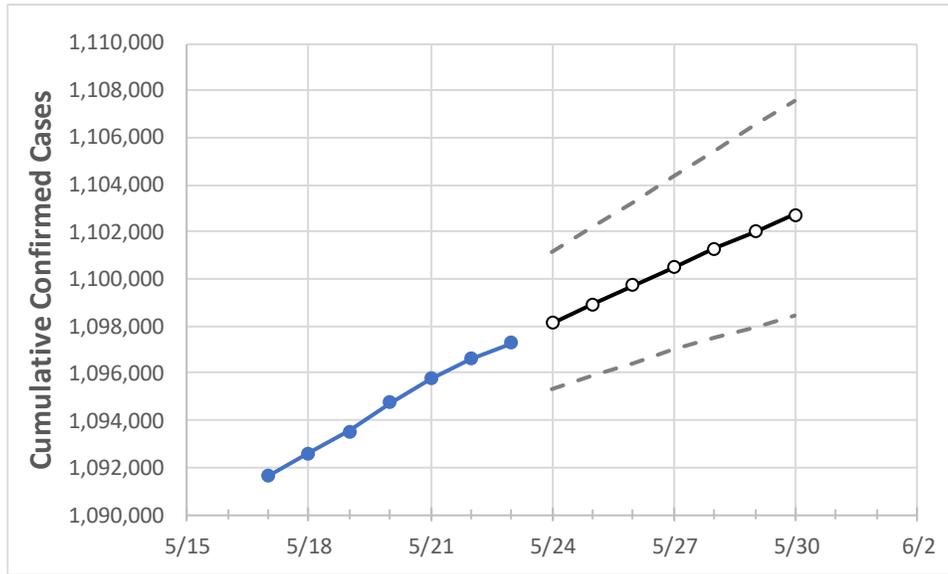
IEM's Modeling Lead

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Ohio	1,094,742	1,095,746	1,096,617	1,097,300	1,098,124	1,098,932	1,099,729	1,100,506	1,101,275	1,102,015	1,102,731

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Athens	5,209	5,209	5,209	5,210	5,211	5,212	5,212	5,213	5,214	5,214	5,215
Cuyahoga	113,761	113,913	114,052	114,193	114,317	114,442	114,560	114,679	114,792	114,898	115,008
Franklin	127,109	127,205	127,306	127,371	127,456	127,540	127,622	127,701	127,778	127,853	127,923
Hamilton	80,582	80,641	80,688	80,719	80,759	80,799	80,838	80,876	80,913	80,949	80,984
Lake	20,907	20,928	20,949	20,972	20,991	21,009	21,027	21,045	21,063	21,080	21,097
Lorain	25,294	25,319	25,341	25,357	25,377	25,397	25,416	25,434	25,453	25,471	25,488
Lucas	42,763	42,817	42,862	42,881	42,919	42,956	42,991	43,025	43,057	43,089	43,120
Mahoning	21,900	21,940	21,972	22,003	22,035	22,067	22,099	22,131	22,164	22,196	22,229
Medina	15,427	15,441	15,452	15,464	15,476	15,488	15,499	15,510	15,522	15,533	15,544
Miami	10,731	10,737	10,740	10,745	10,749	10,754	10,758	10,762	10,766	10,770	10,774
Summit	47,773	47,828	47,873	47,908	47,950	47,991	48,032	48,072	48,109	48,145	48,182

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:											
	5/20	5/21	5/22	5/23	5/25			5/27			5/29					
Athens	5,209	5,209	5,209	5,210	5,212	(1,042)	[250]	{125}	5,213	(1,043)	[250]	{125}	5,214	(1,043)	[250]	{125}
Cuyahoga	113,761	113,913	114,052	114,193	114,442	(22,888)	[5,493]	{2,747}	114,679	(22,936)	[5,505]	{2,752}	114,898	(22,980)	[5,515]	{2,758}
Franklin	127,109	127,205	127,306	127,371	127,540	(25,508)	[6,122]	{3,061}	127,701	(25,540)	[6,130]	{3,065}	127,853	(25,571)	[6,137]	{3,068}
Hamilton	80,582	80,641	80,688	80,719	80,799	(16,160)	[3,878]	{1,939}	80,876	(16,175)	[3,882]	{1,941}	80,949	(16,190)	[3,886]	{1,943}
Lake	20,907	20,928	20,949	20,972	21,009	(4,202)	[1,008]	{504}	21,045	(4,209)	[1,010]	{505}	21,080	(4,216)	[1,012]	{506}
Lorain	25,294	25,319	25,341	25,357	25,397	(5,079)	[1,219]	{610}	25,434	(5,087)	[1,221]	{610}	25,471	(5,094)	[1,223]	{611}
Lucas	42,763	42,817	42,862	42,881	42,956	(8,591)	[2,062]	{1,031}	43,025	(8,605)	[2,065]	{1,033}	43,089	(8,618)	[2,068]	{1,034}
Mahoning	21,900	21,940	21,972	22,003	22,067	(4,413)	[1,059]	{530}	22,131	(4,426)	[1,062]	{531}	22,196	(4,439)	[1,065]	{533}
Medina	15,427	15,441	15,452	15,464	15,488	(3,098)	[743]	{372}	15,510	(3,102)	[744]	{372}	15,533	(3,107)	[746]	{373}
Miami	10,731	10,737	10,740	10,745	10,754	(2,151)	[516]	{258}	10,762	(2,152)	[517]	{258}	10,770	(2,154)	[517]	{258}
Summit	47,773	47,828	47,873	47,908	47,991	(9,598)	[2,304]	{1,152}	48,072	(9,614)	[2,307]	{1,154}	48,145	(9,629)	[2,311]	{1,155}

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.