

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

Date: 5/26/21

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 5/26/21 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.

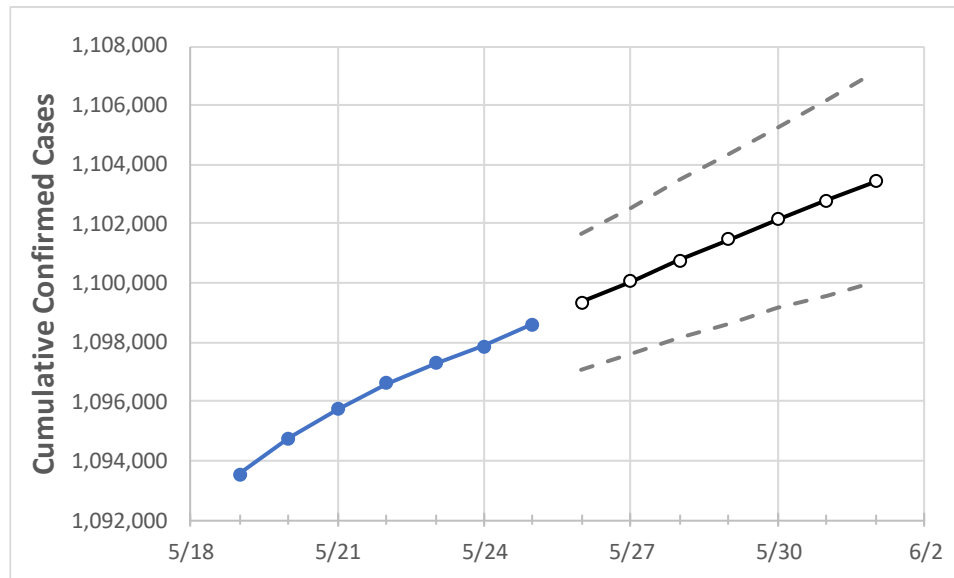
IEM's Modeling Lead

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Ohio	1,096,617	1,097,300	1,097,867	1,098,594	1,099,332	1,100,052	1,100,762	1,101,469	1,102,140	1,102,797	1,103,425

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Athens	5,209	5,210	5,212	5,213	5,214	5,214	5,215	5,215	5,216	5,216	5,217
Cuyahoga	114,052	114,193	114,272	114,378	114,491	114,602	114,707	114,808	114,909	115,004	115,101
Franklin	127,306	127,371	127,421	127,494	127,570	127,644	127,715	127,783	127,851	127,915	127,979
Hamilton	80,688	80,719	80,741	80,780	80,815	80,849	80,882	80,914	80,944	80,973	81,003
Lake	20,949	20,972	20,981	20,991	21,007	21,022	21,037	21,052	21,066	21,079	21,092
Lorain	25,341	25,357	25,380	25,406	25,428	25,449	25,470	25,491	25,511	25,531	25,551
Lucas	42,862	42,881	42,907	42,945	42,979	43,011	43,042	43,072	43,101	43,128	43,155
Mahoning	21,972	22,003	22,027	22,045	22,074	22,103	22,131	22,160	22,189	22,218	22,246
Medina	15,452	15,464	15,472	15,486	15,497	15,508	15,518	15,529	15,540	15,550	15,560
Miami	10,740	10,745	10,752	10,762	10,767	10,773	10,778	10,783	10,789	10,794	10,799
Summit	47,873	47,908	47,932	47,953	47,988	48,022	48,054	48,086	48,118	48,148	48,176

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:											
	5/22	5/23	5/24	5/25	5/27				5/29				5/31			
Athens	5,209	5,210	5,212	5,213	5,214	(1,043)	[250]	{125}	5,215	(1,043)	[250]	{125}	5,216	(1,043)	[250]	{125}
Cuyahoga	114,052	114,193	114,272	114,378	114,602	(22,920)	[5,501]	{2,750}	114,808	(22,962)	[5,511]	{2,755}	115,004	(23,001)	[5,520]	{2,760}
Franklin	127,306	127,371	127,421	127,494	127,644	(25,529)	[6,127]	{3,063}	127,783	(25,557)	[6,134]	{3,067}	127,915	(25,583)	[6,140]	{3,070}
Hamilton	80,688	80,719	80,741	80,780	80,849	(16,170)	[3,881]	{1,940}	80,914	(16,183)	[3,884]	{1,942}	80,973	(16,195)	[3,887]	{1,943}
Lake	20,949	20,972	20,981	20,991	21,022	(4,204)	[1,009]	{505}	21,052	(4,210)	[1,010]	{505}	21,079	(4,216)	[1,012]	{506}
Lorain	25,341	25,357	25,380	25,406	25,449	(5,090)	[1,222]	{611}	25,491	(5,098)	[1,224]	{612}	25,531	(5,106)	[1,225]	{613}
Lucas	42,862	42,881	42,907	42,945	43,011	(8,602)	[2,065]	{1,032}	43,072	(8,614)	[2,067]	{1,034}	43,128	(8,626)	[2,070]	{1,035}
Mahoning	21,972	22,003	22,027	22,045	22,103	(4,421)	[1,061]	{530}	22,160	(4,432)	[1,064]	{532}	22,218	(4,444)	[1,066]	{533}
Medina	15,452	15,464	15,472	15,486	15,508	(3,102)	[744]	{372}	15,529	(3,106)	[745]	{373}	15,550	(3,110)	[746]	{373}
Miami	10,740	10,745	10,752	10,762	10,773	(2,155)	[517]	{259}	10,783	(2,157)	[518]	{259}	10,794	(2,159)	[518]	{259}
Summit	47,873	47,908	47,932	47,953	48,022	(9,604)	[2,305]	{1,153}	48,086	(9,617)	[2,308]	{1,154}	48,148	(9,630)	[2,311]	{1,156}

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.