

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

Date: 3/4/21

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 3/4/21 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.

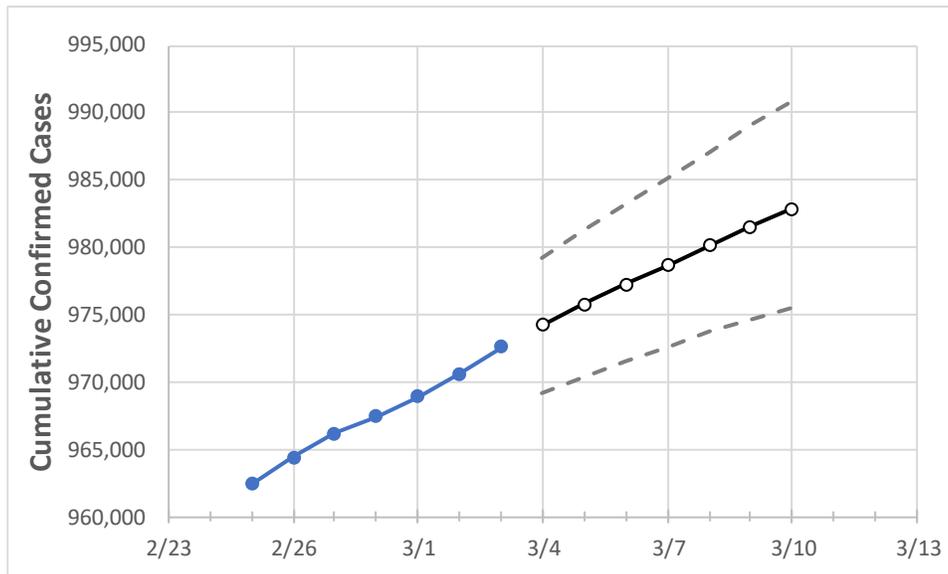
IEM's Modeling Lead

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Ohio	967,422	968,874	970,583	972,605	974,191	975,752	977,252	978,695	980,129	981,521	982,884	

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Athens	4,631	4,637	4,644	4,650	4,659	4,668	4,676	4,683	4,691	4,698	4,705	
Cuyahoga	95,484	95,705	95,912	96,186	96,385	96,580	96,777	96,973	97,159	97,351	97,544	
Franklin	111,851	111,987	112,182	112,367	112,529	112,685	112,837	112,988	113,135	113,276	113,417	
Hamilton	73,202	73,287	73,415	73,572	73,691	73,805	73,916	74,022	74,125	74,225	74,320	
Lake	18,358	18,379	18,411	18,445	18,474	18,502	18,530	18,556	18,582	18,608	18,632	
Lorain	21,952	21,994	22,016	22,068	22,105	22,141	22,175	22,207	22,239	22,270	22,298	
Lucas	35,217	35,279	35,389	35,489	35,581	35,673	35,765	35,856	35,948	36,042	36,135	
Mahoning	19,402	19,444	19,470	19,509	19,539	19,569	19,597	19,625	19,652	19,679	19,704	
Medina	13,347	13,370	13,394	13,423	13,448	13,471	13,495	13,518	13,539	13,561	13,581	
Miami	10,006	10,011	10,022	10,035	10,045	10,054	10,064	10,072	10,081	10,090	10,098	
Summit	40,110	40,184	40,266	40,384	40,467	40,550	40,630	40,706	40,784	40,860	40,933	

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:											
	2/28	3/1	3/2	3/3	3/5			3/7			3/9					
Athens	4,631	4,637	4,644	4,650	4,668	(934)	[224]	{112}	4,683	(937)	[225]	{112}	4,698	(940)	[226]	{113}
Cuyahoga	95,484	95,705	95,912	96,186	96,580	(19,316)	[4,636]	{2,318}	96,973	(19,395)	[4,655]	{2,327}	97,351	(19,470)	[4,673]	{2,336}
Franklin	111,851	111,987	112,182	112,367	112,685	(22,537)	[5,409]	{2,704}	112,988	(22,598)	[5,423]	{2,712}	113,276	(22,655)	[5,437]	{2,719}
Hamilton	73,202	73,287	73,415	73,572	73,805	(14,761)	[3,543]	{1,771}	74,022	(14,804)	[3,553]	{1,777}	74,225	(14,845)	[3,563]	{1,781}
Lake	18,358	18,379	18,411	18,445	18,502	(3,700)	[888]	{444}	18,556	(3,711)	[891]	{445}	18,608	(3,722)	[893]	{447}
Lorain	21,952	21,994	22,016	22,068	22,141	(4,428)	[1,063]	{531}	22,207	(4,441)	[1,066]	{533}	22,270	(4,454)	[1,069]	{534}
Lucas	35,217	35,279	35,389	35,489	35,673	(7,135)	[1,712]	{856}	35,856	(7,171)	[1,721]	{861}	36,042	(7,208)	[1,730]	{865}
Mahoning	19,402	19,444	19,470	19,509	19,569	(3,914)	[939]	{470}	19,625	(3,925)	[942]	{471}	19,679	(3,936)	[945]	{472}
Medina	13,347	13,370	13,394	13,423	13,471	(2,694)	[647]	{323}	13,518	(2,704)	[649]	{324}	13,561	(2,712)	[651]	{325}
Miami	10,006	10,011	10,022	10,035	10,054	(2,011)	[483]	{241}	10,072	(2,014)	[483]	{242}	10,090	(2,018)	[484]	{242}
Summit	40,110	40,184	40,266	40,384	40,550	(8,110)	[1,946]	{973}	40,706	(8,141)	[1,954]	{977}	40,860	(8,172)	[1,961]	{981}

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.