

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

Date: 4/28/21

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 4/28/21 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.

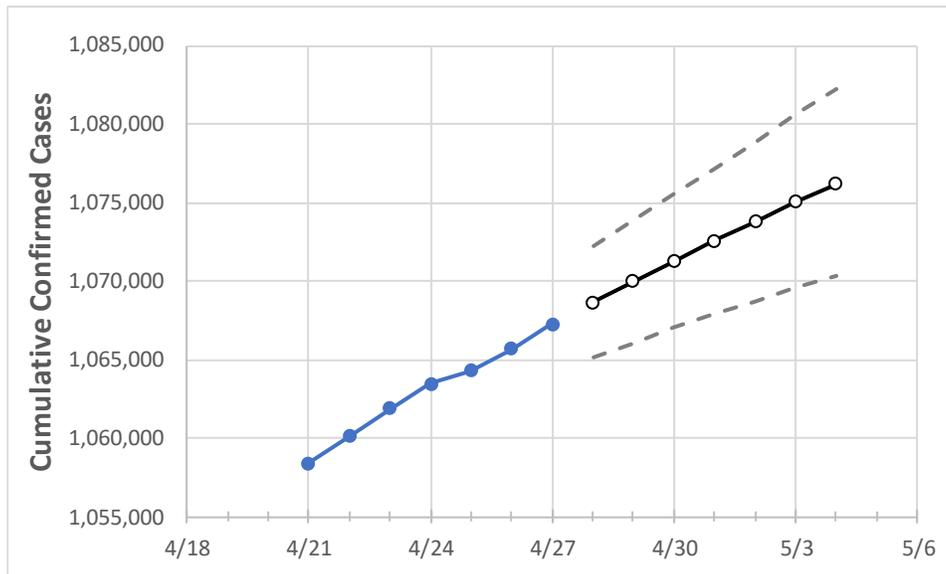
IEM's Modeling Lead

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:							
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	
Ohio	1,063,433	1,064,306	1,065,702	1,067,262	1,068,621	1,069,964	1,071,270	1,072,556	1,073,779	1,075,016	1,076,199	

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:							
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	
Athens	5,118	5,121	5,131	5,135	5,146	5,157	5,167	5,178	5,190	5,200	5,211	
Cuyahoga	108,822	108,973	109,249	109,518	109,755	109,991	110,224	110,457	110,680	110,906	111,124	
Franklin	123,556	123,683	123,893	124,082	124,250	124,416	124,574	124,729	124,879	125,026	125,166	
Hamilton	78,864	78,926	78,984	79,084	79,173	79,263	79,351	79,439	79,525	79,609	79,694	
Lake	20,244	20,261	20,285	20,318	20,345	20,372	20,397	20,422	20,447	20,471	20,494	
Lorain	24,476	24,493	24,525	24,562	24,594	24,624	24,654	24,684	24,713	24,739	24,767	
Lucas	40,911	40,942	41,037	41,122	41,213	41,305	41,391	41,476	41,559	41,639	41,717	
Mahoning	21,098	21,120	21,150	21,184	21,209	21,235	21,259	21,283	21,306	21,328	21,350	
Medina	15,027	15,036	15,053	15,073	15,090	15,106	15,121	15,136	15,150	15,164	15,177	
Miami	10,590	10,600	10,604	10,610	10,616	10,623	10,629	10,635	10,640	10,646	10,651	
Summit	45,989	46,030	46,111	46,171	46,240	46,306	46,369	46,430	46,489	46,546	46,601	

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:											
	4/24	4/25	4/26	4/27	4/29			5/1			5/3					
Athens	5,118	5,121	5,131	5,135	5,157	(1,031)	[248]	{124}	5,178	(1,036)	[249]	{124}	5,200	(1,040)	[250]	{125}
Cuyahoga	108,822	108,973	109,249	109,518	109,991	(21,998)	[5,280]	{2,640}	110,457	(22,091)	[5,302]	{2,651}	110,906	(22,181)	[5,323]	{2,662}
Franklin	123,556	123,683	123,893	124,082	124,416	(24,883)	[5,972]	{2,986}	124,729	(24,946)	[5,987]	{2,994}	125,026	(25,005)	[6,001]	{3,001}
Hamilton	78,864	78,926	78,984	79,084	79,263	(15,853)	[3,805]	{1,902}	79,439	(15,888)	[3,813]	{1,907}	79,609	(15,922)	[3,821]	{1,911}
Lake	20,244	20,261	20,285	20,318	20,372	(4,074)	[978]	{489}	20,422	(4,084)	[980]	{490}	20,471	(4,094)	[983]	{491}
Lorain	24,476	24,493	24,525	24,562	24,624	(4,925)	[1,182]	{591}	24,684	(4,937)	[1,185]	{592}	24,739	(4,948)	[1,187]	{594}
Lucas	40,911	40,942	41,037	41,122	41,305	(8,261)	[1,983]	{991}	41,476	(8,295)	[1,991]	{995}	41,639	(8,328)	[1,999]	{999}
Mahoning	21,098	21,120	21,150	21,184	21,235	(4,247)	[1,019]	{510}	21,283	(4,257)	[1,022]	{511}	21,328	(4,266)	[1,024]	{512}
Medina	15,027	15,036	15,053	15,073	15,106	(3,021)	[725]	{363}	15,136	(3,027)	[727]	{363}	15,164	(3,033)	[728]	{364}
Miami	10,590	10,600	10,604	10,610	10,623	(2,125)	[510]	{255}	10,635	(2,127)	[510]	{255}	10,646	(2,129)	[511]	{256}
Summit	45,989	46,030	46,111	46,171	46,306	(9,261)	[2,223]	{1,111}	46,430	(9,286)	[2,229]	{1,114}	46,546	(9,309)	[2,234]	{1,117}

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.