

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

Date: 4/29/21

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 4/29/21 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.

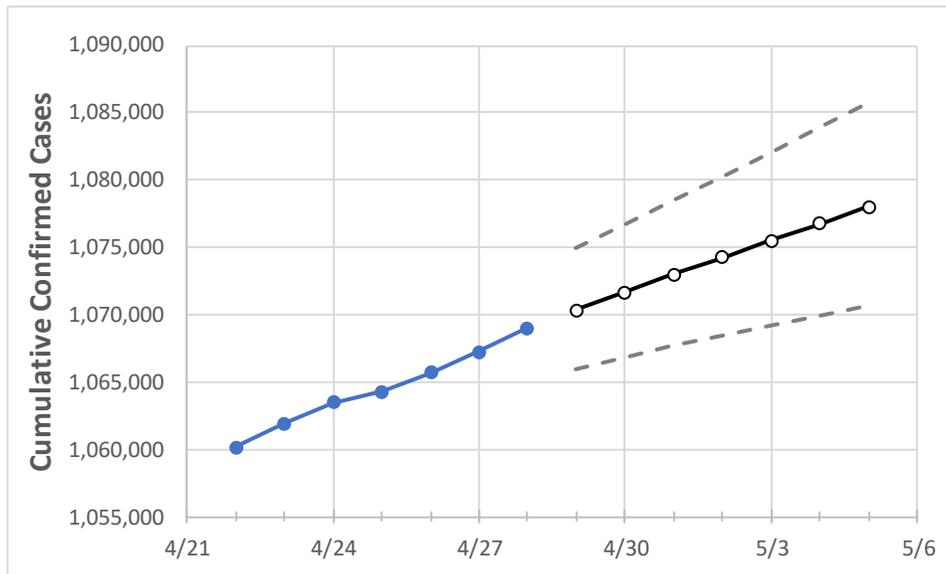
IEM's Modeling Lead

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Ohio	1,064,306	1,065,702	1,067,262	1,068,985	1,070,343	1,071,677	1,072,982	1,074,268	1,075,509	1,076,771	1,077,988

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Athens	5,121	5,131	5,135	5,144	5,155	5,165	5,175	5,185	5,196	5,206	5,216
Cuyahoga	108,973	109,249	109,518	109,750	109,985	110,216	110,446	110,670	110,898	111,118	111,328
Franklin	123,683	123,893	124,082	124,247	124,407	124,567	124,719	124,869	125,012	125,159	125,302
Hamilton	78,926	78,984	79,084	79,199	79,291	79,384	79,474	79,567	79,657	79,746	79,832
Lake	20,261	20,285	20,318	20,339	20,365	20,390	20,414	20,438	20,460	20,482	20,504
Lorain	24,493	24,525	24,562	24,585	24,615	24,641	24,669	24,697	24,722	24,748	24,772
Lucas	40,942	41,037	41,122	41,251	41,346	41,442	41,534	41,622	41,712	41,796	41,878
Mahoning	21,120	21,150	21,184	21,208	21,232	21,256	21,279	21,303	21,325	21,345	21,366
Medina	15,036	15,053	15,073	15,098	15,115	15,131	15,148	15,164	15,179	15,193	15,207
Miami	10,600	10,604	10,610	10,618	10,625	10,631	10,637	10,643	10,649	10,655	10,660
Summit	46,030	46,111	46,171	46,339	46,411	46,479	46,544	46,610	46,672	46,731	46,790

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:											
	4/25	4/26	4/27	4/28	4/30			5/2			5/4					
Athens	5,121	5,131	5,135	5,144	5,165	(1,033)	[248]	{124}	5,185	(1,037)	[249]	{124}	5,206	(1,041)	[250]	{125}
Cuyahoga	108,973	109,249	109,518	109,750	110,216	(22,043)	[5,290]	{2,645}	110,670	(22,134)	[5,312]	{2,656}	111,118	(22,224)	[5,334]	{2,667}
Franklin	123,683	123,893	124,082	124,247	124,567	(24,913)	[5,979]	{2,990}	124,869	(24,974)	[5,994]	{2,997}	125,159	(25,032)	[6,008]	{3,004}
Hamilton	78,926	78,984	79,084	79,199	79,384	(15,877)	[3,810]	{1,905}	79,567	(15,913)	[3,819]	{1,910}	79,746	(15,949)	[3,828]	{1,914}
Lake	20,261	20,285	20,318	20,339	20,390	(4,078)	[979]	{489}	20,438	(4,088)	[981]	{491}	20,482	(4,096)	[983]	{492}
Lorain	24,493	24,525	24,562	24,585	24,641	(4,928)	[1,183]	{591}	24,697	(4,939)	[1,185]	{593}	24,748	(4,950)	[1,188]	{594}
Lucas	40,942	41,037	41,122	41,251	41,442	(8,288)	[1,989]	{995}	41,622	(8,324)	[1,998]	{999}	41,796	(8,359)	[2,006]	{1,003}
Mahoning	21,120	21,150	21,184	21,208	21,256	(4,251)	[1,020]	{510}	21,303	(4,261)	[1,023]	{511}	21,345	(4,269)	[1,025]	{512}
Medina	15,036	15,053	15,073	15,098	15,131	(3,026)	[726]	{363}	15,164	(3,033)	[728]	{364}	15,193	(3,039)	[729]	{365}
Miami	10,600	10,604	10,610	10,618	10,631	(2,126)	[510]	{255}	10,643	(2,129)	[511]	{255}	10,655	(2,131)	[511]	{256}
Summit	46,030	46,111	46,171	46,339	46,479	(9,296)	[2,231]	{1,116}	46,610	(9,322)	[2,237]	{1,119}	46,731	(9,346)	[2,243]	{1,122}

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.