

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

Date: 4/27/21

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 4/27/21 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.

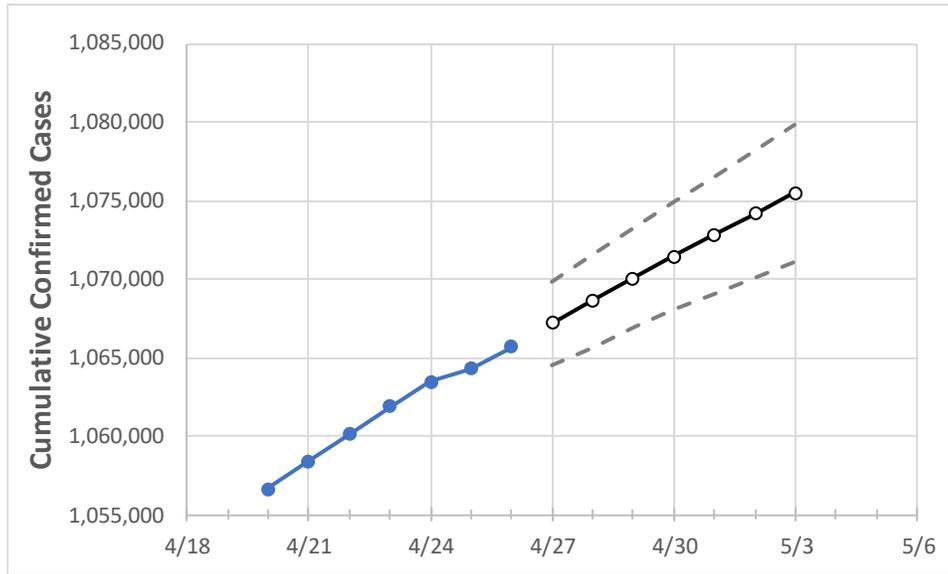
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Ohio	1,061,907	1,063,433	1,064,306	1,065,702	1,067,193	1,068,642	1,070,068	1,071,446	1,072,806	1,074,160	1,075,459

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Athens	5,111	5,118	5,121	5,131	5,144	5,157	5,170	5,184	5,197	5,211	5,225
Cuyahoga	108,545	108,822	108,973	109,249	109,507	109,767	110,025	110,277	110,528	110,782	111,027
Franklin	123,407	123,556	123,683	123,893	124,085	124,270	124,455	124,636	124,810	124,980	125,151
Hamilton	78,760	78,864	78,926	78,984	79,078	79,171	79,262	79,352	79,441	79,530	79,621
Lake	20,215	20,244	20,261	20,285	20,316	20,346	20,376	20,405	20,434	20,462	20,489
Lorain	24,442	24,476	24,493	24,525	24,566	24,608	24,648	24,689	24,729	24,769	24,809
Lucas	40,785	40,911	40,942	41,037	41,150	41,266	41,380	41,493	41,601	41,715	41,828
Mahoning	21,079	21,098	21,120	21,150	21,178	21,205	21,232	21,258	21,284	21,309	21,333
Medina	15,007	15,027	15,036	15,053	15,071	15,089	15,107	15,123	15,139	15,155	15,170
Miami	10,585	10,590	10,600	10,604	10,612	10,619	10,627	10,635	10,642	10,649	10,656
Summit	45,895	45,989	46,030	46,111	46,192	46,271	46,346	46,421	46,493	46,564	46,631

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:											
	4/23	4/24	4/25	4/26	4/28				4/30				5/2			
Athens	5,111	5,118	5,121	5,131	5,157	(1,031)	[248]	{124}	5,184	(1,037)	[249]	{124}	5,211	(1,042)	[250]	{125}
Cuyahoga	108,545	108,822	108,973	109,249	109,767	(21,953)	[5,269]	{2,634}	110,277	(22,055)	[5,293]	{2,647}	110,782	(22,156)	[5,318]	{2,659}
Franklin	123,407	123,556	123,683	123,893	124,270	(24,854)	[5,965]	{2,982}	124,636	(24,927)	[5,983]	{2,991}	124,980	(24,996)	[5,999]	{3,000}
Hamilton	78,760	78,864	78,926	78,984	79,171	(15,834)	[3,800]	{1,900}	79,352	(15,870)	[3,809]	{1,904}	79,530	(15,906)	[3,817]	{1,909}
Lake	20,215	20,244	20,261	20,285	20,346	(4,069)	[977]	{488}	20,405	(4,081)	[979]	{490}	20,462	(4,092)	[982]	{491}
Lorain	24,442	24,476	24,493	24,525	24,608	(4,922)	[1,181]	{591}	24,689	(4,938)	[1,185]	{593}	24,769	(4,954)	[1,189]	{594}
Lucas	40,785	40,911	40,942	41,037	41,266	(8,253)	[1,981]	{990}	41,493	(8,299)	[1,992]	{996}	41,715	(8,343)	[2,002]	{1,001}
Mahoning	21,079	21,098	21,120	21,150	21,205	(4,241)	[1,018]	{509}	21,258	(4,252)	[1,020]	{510}	21,309	(4,262)	[1,023]	{511}
Medina	15,007	15,027	15,036	15,053	15,089	(3,018)	[724]	{362}	15,123	(3,025)	[726]	{363}	15,155	(3,031)	[727]	{364}
Miami	10,585	10,590	10,600	10,604	10,619	(2,124)	[510]	{255}	10,635	(2,127)	[510]	{255}	10,649	(2,130)	[511]	{256}
Summit	45,895	45,989	46,030	46,111	46,271	(9,254)	[2,221]	{1,111}	46,421	(9,284)	[2,228]	{1,114}	46,564	(9,313)	[2,235]	{1,118}

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.