

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

Date: 6/16/21

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 6/16/21 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.

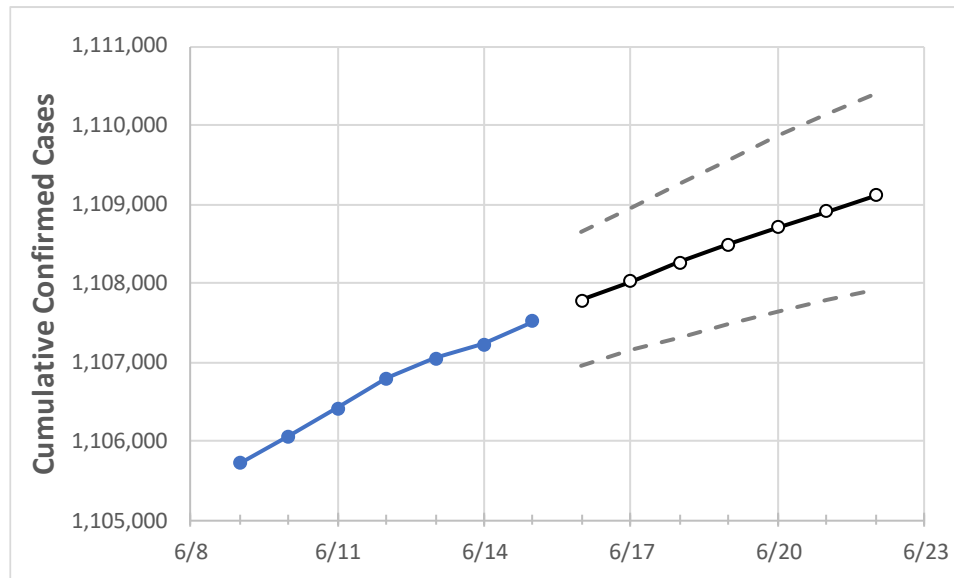
IEM's Modeling Lead

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:						
	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22
Ohio	1,106,796	1,107,047	1,107,225	1,107,521	1,107,777	1,108,018	1,108,257	1,108,485	1,108,705	1,108,914	1,109,109

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:						
	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22
Athens	5,233	5,233	5,233	5,233	5,234	5,234	5,235	5,236	5,237	5,237	5,238
Cuyahoga	115,579	115,597	115,632	115,671	115,702	115,731	115,759	115,784	115,808	115,832	115,854
Franklin	128,460	128,492	128,506	128,549	128,581	128,613	128,644	128,673	128,701	128,728	128,753
Hamilton	81,275	81,299	81,310	81,321	81,341	81,362	81,381	81,401	81,421	81,440	81,458
Lake	21,133	21,135	21,139	21,145	21,148	21,151	21,154	21,156	21,159	21,161	21,163
Lorain	25,631	25,641	25,642	25,642	25,649	25,655	25,661	25,667	25,673	25,678	25,683
Lucas	43,289	43,303	43,309	43,320	43,330	43,339	43,349	43,357	43,365	43,373	43,380
Mahoning	22,327	22,330	22,332	22,340	22,347	22,353	22,359	22,364	22,370	22,375	22,380
Medina	15,592	15,593	15,597	15,597	15,600	15,604	15,607	15,610	15,613	15,615	15,618
Miami	10,832	10,835	10,837	10,840	10,842	10,845	10,847	10,849	10,851	10,853	10,855
Summit	48,327	48,339	48,356	48,370	48,381	48,390	48,400	48,408	48,417	48,425	48,433

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:											
	6/12	6/13	6/14	6/15	6/17				6/19				6/21			
Athens	5,233	5,233	5,233	5,233	5,234	(1,047)	[251]	{126}	5,236	(1,047)	[251]	{126}	5,237	(1,047)	[251]	{126}
Cuyahoga	115,579	115,597	115,632	115,671	115,731	(23,146)	[5,555]	{2,778}	115,784	(23,157)	[5,558]	{2,779}	115,832	(23,166)	[5,560]	{2,780}
Franklin	128,460	128,492	128,506	128,549	128,613	(25,723)	[6,173]	{3,087}	128,673	(25,735)	[6,176]	{3,088}	128,728	(25,746)	[6,179]	{3,089}
Hamilton	81,275	81,299	81,310	81,321	81,362	(16,272)	[3,905]	{1,953}	81,401	(16,280)	[3,907]	{1,954}	81,440	(16,288)	[3,909]	{1,955}
Lake	21,133	21,135	21,139	21,145	21,151	(4,230)	[1,015]	{508}	21,156	(4,231)	[1,016]	{508}	21,161	(4,232)	[1,016]	{508}
Lorain	25,631	25,641	25,642	25,642	25,655	(5,131)	[1,231]	{616}	25,667	(5,133)	[1,232]	{616}	25,678	(5,136)	[1,233]	{616}
Lucas	43,289	43,303	43,309	43,320	43,339	(8,668)	[2,080]	{1,040}	43,357	(8,671)	[2,081]	{1,041}	43,373	(8,675)	[2,082]	{1,041}
Mahoning	22,327	22,330	22,332	22,340	22,353	(4,471)	[1,073]	{536}	22,364	(4,473)	[1,073]	{537}	22,375	(4,475)	[1,074]	{537}
Medina	15,592	15,593	15,597	15,597	15,604	(3,121)	[749]	{374}	15,610	(3,122)	[749]	{375}	15,615	(3,123)	[750]	{375}
Miami	10,832	10,835	10,837	10,840	10,845	(2,169)	[521]	{260}	10,849	(2,170)	[521]	{260}	10,853	(2,171)	[521]	{260}
Summit	48,327	48,339	48,356	48,370	48,390	(9,678)	[2,323]	{1,161}	48,408	(9,682)	[2,324]	{1,162}	48,425	(9,685)	[2,324]	{1,162}

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.