

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

Date: 6/11/21

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 6/11/21 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.

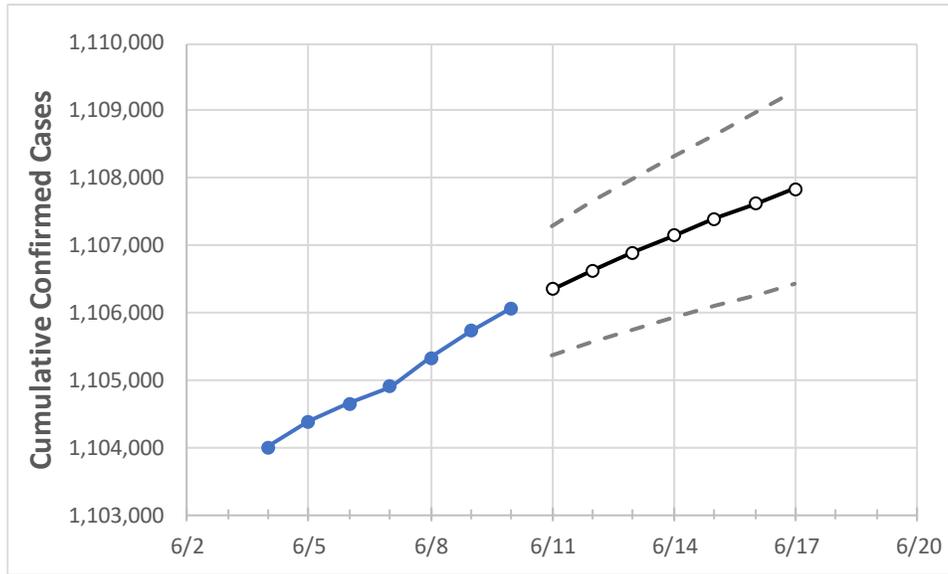
IEM's Modeling Lead

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:						
	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17
Ohio	1,104,903	1,105,329	1,105,720	1,106,064	1,106,355	1,106,629	1,106,888	1,107,138	1,107,389	1,107,621	1,107,839

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:						
	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17
Athens	5,231	5,233	5,233	5,233	5,234	5,236	5,237	5,239	5,240	5,241	5,243
Cuyahoga	115,365	115,418	115,469	115,505	115,546	115,584	115,620	115,654	115,687	115,719	115,750
Franklin	128,222	128,266	128,322	128,361	128,395	128,430	128,462	128,492	128,522	128,551	128,578
Hamilton	81,092	81,130	81,165	81,182	81,201	81,219	81,236	81,252	81,269	81,285	81,301
Lake	21,105	21,113	21,118	21,121	21,125	21,128	21,131	21,134	21,137	21,140	21,142
Lorain	25,571	25,588	25,602	25,616	25,624	25,631	25,639	25,646	25,652	25,658	25,664
Lucas	43,203	43,234	43,248	43,269	43,280	43,290	43,300	43,310	43,318	43,327	43,335
Mahoning	22,270	22,286	22,299	22,315	22,325	22,334	22,343	22,352	22,360	22,367	22,375
Medina	15,570	15,575	15,579	15,584	15,588	15,591	15,594	15,597	15,600	15,603	15,605
Miami	10,815	10,817	10,819	10,820	10,822	10,824	10,826	10,827	10,829	10,831	10,832
Summit	48,265	48,273	48,294	48,306	48,318	48,330	48,341	48,351	48,361	48,370	48,379

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:											
	6/7	6/8	6/9	6/10	6/12			6/14			6/16					
Athens	5,231	5,233	5,233	5,233	5,236	(1,047)	[251]	{126}	5,239	(1,048)	[251]	{126}	5,241	(1,048)	[252]	{126}
Cuyahoga	115,365	115,418	115,469	115,505	115,584	(23,117)	[5,548]	{2,774}	115,654	(23,131)	[5,551]	{2,776}	115,719	(23,144)	[5,554]	{2,777}
Franklin	128,222	128,266	128,322	128,361	128,430	(25,686)	[6,165]	{3,082}	128,492	(25,698)	[6,168]	{3,084}	128,551	(25,710)	[6,170]	{3,085}
Hamilton	81,092	81,130	81,165	81,182	81,219	(16,244)	[3,899]	{1,949}	81,252	(16,250)	[3,900]	{1,950}	81,285	(16,257)	[3,902]	{1,951}
Lake	21,105	21,113	21,118	21,121	21,128	(4,226)	[1,014]	{507}	21,134	(4,227)	[1,014]	{507}	21,140	(4,228)	[1,015]	{507}
Lorain	25,571	25,588	25,602	25,616	25,631	(5,126)	[1,230]	{615}	25,646	(5,129)	[1,231]	{615}	25,658	(5,132)	[1,232]	{616}
Lucas	43,203	43,234	43,248	43,269	43,290	(8,658)	[2,078]	{1,039}	43,310	(8,662)	[2,079]	{1,039}	43,327	(8,665)	[2,080]	{1,040}
Mahoning	22,270	22,286	22,299	22,315	22,334	(4,467)	[1,072]	{536}	22,352	(4,470)	[1,073]	{536}	22,367	(4,473)	[1,074]	{537}
Medina	15,570	15,575	15,579	15,584	15,591	(3,118)	[748]	{374}	15,597	(3,119)	[749]	{374}	15,603	(3,121)	[749]	{374}
Miami	10,815	10,817	10,819	10,820	10,824	(2,165)	[520]	{260}	10,827	(2,165)	[520]	{260}	10,831	(2,166)	[520]	{260}
Summit	48,265	48,273	48,294	48,306	48,330	(9,666)	[2,320]	{1,160}	48,351	(9,670)	[2,321]	{1,160}	48,370	(9,674)	[2,322]	{1,161}

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.