

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

Date: 6/14/21

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 6/14/21 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.

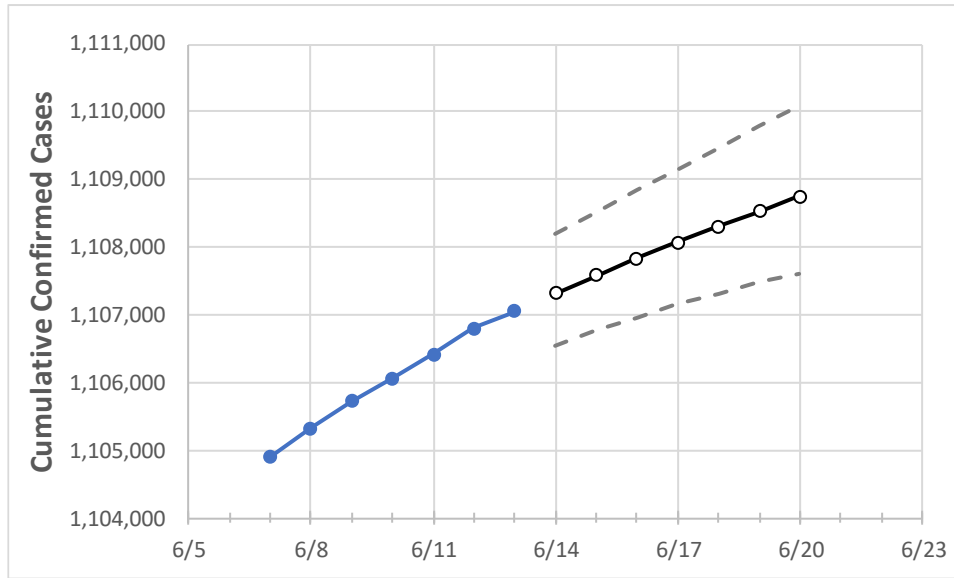
IEM's Modeling Lead

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Ohio	1,106,064	1,106,411	1,106,796	1,107,047	1,107,321	1,107,582	1,107,834	1,108,072	1,108,308	1,108,532	1,108,750

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Athens	5,233	5,233	5,233	5,233	5,235	5,237	5,239	5,241	5,243	5,245	5,247
Cuyahoga	115,505	115,549	115,579	115,597	115,629	115,659	115,687	115,714	115,739	115,764	115,786
Franklin	128,361	128,395	128,460	128,492	128,526	128,559	128,591	128,622	128,651	128,681	128,710
Hamilton	81,182	81,216	81,275	81,299	81,320	81,342	81,362	81,384	81,404	81,424	81,443
Lake	21,121	21,126	21,133	21,135	21,138	21,141	21,144	21,147	21,149	21,151	21,154
Lorain	25,616	25,622	25,631	25,641	25,649	25,656	25,664	25,671	25,678	25,685	25,691
Lucas	43,269	43,281	43,289	43,303	43,314	43,324	43,334	43,343	43,352	43,361	43,369
Mahoning	22,315	22,324	22,327	22,330	22,338	22,345	22,352	22,358	22,364	22,370	22,375
Medina	15,584	15,588	15,592	15,593	15,596	15,599	15,602	15,605	15,608	15,610	15,613
Miami	10,820	10,824	10,832	10,835	10,837	10,840	10,842	10,844	10,847	10,849	10,851
Summit	48,306	48,319	48,327	48,339	48,349	48,360	48,369	48,378	48,387	48,395	48,402

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:											
	6/10	6/11	6/12	6/13	6/15			6/17			6/19					
Athens	5,233	5,233	5,233	5,233	5,237	(1,047)	[251]	{126}	5,241	(1,048)	[252]	{126}	5,245	(1,049)	[252]	{126}
Cuyahoga	115,505	115,549	115,579	115,597	115,659	(23,132)	[5,552]	{2,776}	115,714	(23,143)	[5,554]	{2,777}	115,764	(23,153)	[5,557]	{2,778}
Franklin	128,361	128,395	128,460	128,492	128,559	(25,712)	[6,171]	{3,085}	128,622	(25,724)	[6,174]	{3,087}	128,681	(25,736)	[6,177]	{3,088}
Hamilton	81,182	81,216	81,275	81,299	81,342	(16,268)	[3,904]	{1,952}	81,384	(16,277)	[3,906]	{1,953}	81,424	(16,285)	[3,908]	{1,954}
Lake	21,121	21,126	21,133	21,135	21,141	(4,228)	[1,015]	{507}	21,147	(4,229)	[1,015]	{508}	21,151	(4,230)	[1,015]	{508}
Lorain	25,616	25,622	25,631	25,641	25,656	(5,131)	[1,232]	{616}	25,671	(5,134)	[1,232]	{616}	25,685	(5,137)	[1,233]	{616}
Lucas	43,269	43,281	43,289	43,303	43,324	(8,665)	[2,080]	{1,040}	43,343	(8,669)	[2,080]	{1,040}	43,361	(8,672)	[2,081]	{1,041}
Mahoning	22,315	22,324	22,327	22,330	22,345	(4,469)	[1,073]	{536}	22,358	(4,472)	[1,073]	{537}	22,370	(4,474)	[1,074]	{537}
Medina	15,584	15,588	15,592	15,593	15,599	(3,120)	[749]	{374}	15,605	(3,121)	[749]	{375}	15,610	(3,122)	[749]	{375}
Miami	10,820	10,824	10,832	10,835	10,840	(2,168)	[520]	{260}	10,844	(2,169)	[521]	{260}	10,849	(2,170)	[521]	{260}
Summit	48,306	48,319	48,327	48,339	48,360	(9,672)	[2,321]	{1,161}	48,378	(9,676)	[2,322]	{1,161}	48,395	(9,679)	[2,323]	{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.