

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

Date: 6/9/21

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 6/9/21 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.

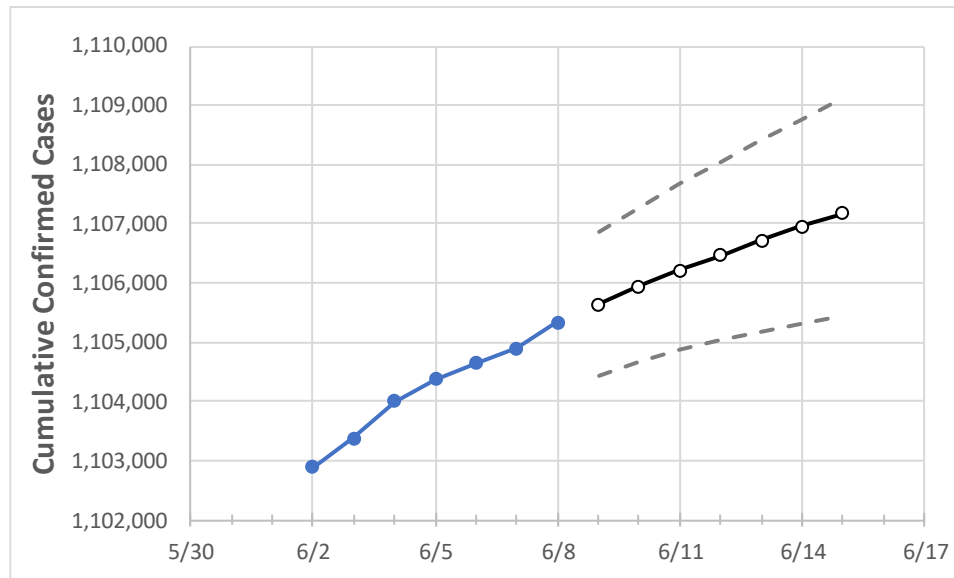
IEM's Modeling Lead

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Ohio	1,104,380	1,104,648	1,104,903	1,105,329	1,105,647	1,105,940	1,106,211	1,106,471	1,106,725	1,106,958	1,107,176

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Athens	5,229	5,230	5,231	5,233	5,234	5,235	5,236	5,237	5,239	5,240	5,241
Cuyahoga	115,283	115,328	115,365	115,418	115,465	115,509	115,551	115,591	115,628	115,664	115,698
Franklin	128,156	128,192	128,222	128,266	128,303	128,337	128,370	128,403	128,434	128,465	128,494
Hamilton	81,066	81,085	81,092	81,130	81,148	81,166	81,183	81,200	81,216	81,231	81,246
Lake	21,100	21,104	21,105	21,113	21,117	21,122	21,126	21,129	21,133	21,136	21,139
Lorain	25,556	25,563	25,571	25,588	25,596	25,603	25,609	25,616	25,622	25,628	25,633
Lucas	43,178	43,187	43,203	43,234	43,246	43,257	43,268	43,277	43,287	43,295	43,303
Mahoning	22,258	22,263	22,270	22,286	22,296	22,306	22,315	22,325	22,334	22,343	22,351
Medina	15,555	15,558	15,570	15,575	15,579	15,583	15,586	15,590	15,593	15,596	15,599
Miami	10,811	10,814	10,815	10,817	10,820	10,822	10,824	10,827	10,829	10,831	10,833
Summit	48,256	48,260	48,265	48,273	48,288	48,300	48,313	48,325	48,336	48,347	48,357

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:											
	6/5	6/6	6/7	6/8	6/10				6/12				6/14			
Athens	5,229	5,230	5,231	5,233	5,235	(1,047)	[251]	{126}	5,237	(1,047)	[251]	{126}	5,240	(1,048)	[252]	{126}
Cuyahoga	115,283	115,328	115,365	115,418	115,509	(23,102)	[5,544]	{2,772}	115,591	(23,118)	[5,548]	{2,774}	115,664	(23,133)	[5,552]	{2,776}
Franklin	128,156	128,192	128,222	128,266	128,337	(25,667)	[6,160]	{3,080}	128,403	(25,681)	[6,163]	{3,082}	128,465	(25,693)	[6,166]	{3,083}
Hamilton	81,066	81,085	81,092	81,130	81,166	(16,233)	[3,896]	{1,948}	81,200	(16,240)	[3,898]	{1,949}	81,231	(16,246)	[3,899]	{1,950}
Lake	21,100	21,104	21,105	21,113	21,122	(4,224)	[1,014]	{507}	21,129	(4,226)	[1,014]	{507}	21,136	(4,227)	[1,015]	{507}
Lorain	25,556	25,563	25,571	25,588	25,603	(5,121)	[1,229]	{614}	25,616	(5,123)	[1,230]	{615}	25,628	(5,126)	[1,230]	{615}
Lucas	43,178	43,187	43,203	43,234	43,257	(8,651)	[2,076]	{1,038}	43,277	(8,655)	[2,077]	{1,039}	43,295	(8,659)	[2,078]	{1,039}
Mahoning	22,258	22,263	22,270	22,286	22,306	(4,461)	[1,071]	{535}	22,325	(4,465)	[1,072]	{536}	22,343	(4,469)	[1,072]	{536}
Medina	15,555	15,558	15,570	15,575	15,583	(3,117)	[748]	{374}	15,590	(3,118)	[748]	{374}	15,596	(3,119)	[749]	{374}
Miami	10,811	10,814	10,815	10,817	10,822	(2,164)	[519]	{260}	10,827	(2,165)	[520]	{260}	10,831	(2,166)	[520]	{260}
Summit	48,256	48,260	48,265	48,273	48,300	(9,660)	[2,318]	{1,159}	48,325	(9,665)	[2,320]	{1,160}	48,347	(9,669)	[2,321]	{1,160}

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.