

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

Date: 2/26/21

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 2/26/21 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.

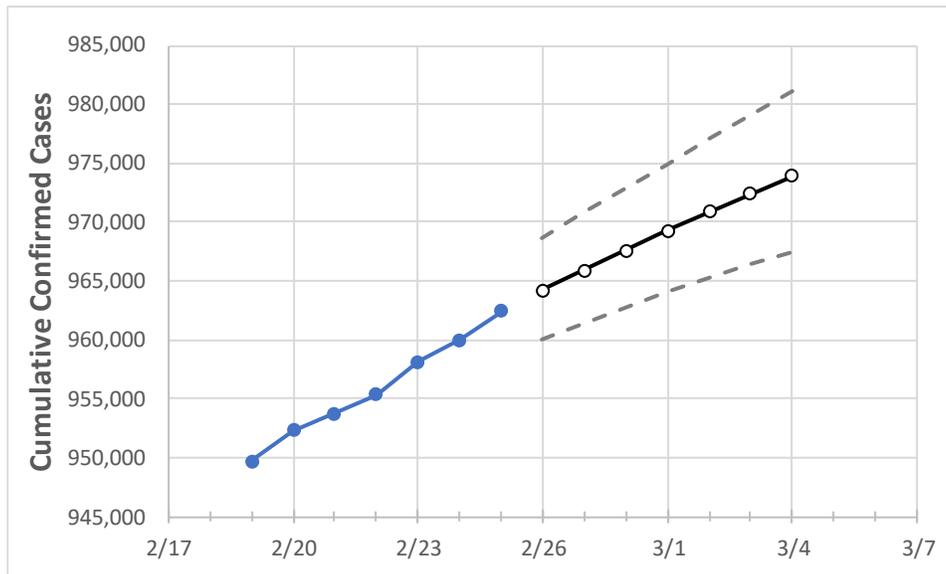
IEM's Modeling Lead

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Ohio	955,378	958,153	959,995	962,404	964,207	965,918	967,602	969,279	970,871	972,429	973,926

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Athens	4,550	4,562	4,573	4,594	4,610	4,626	4,641	4,657	4,672	4,687	4,701
Cuyahoga	94,021	94,420	94,594	94,867	95,037	95,202	95,364	95,525	95,678	95,836	95,985
Franklin	110,653	110,938	111,107	111,312	111,483	111,654	111,820	111,985	112,144	112,299	112,447
Hamilton	72,330	72,486	72,643	72,843	72,987	73,126	73,260	73,393	73,519	73,640	73,762
Lake	18,087	18,178	18,210	18,273	18,313	18,351	18,389	18,427	18,463	18,498	18,533
Lorain	21,667	21,738	21,781	21,846	21,895	21,943	21,989	22,034	22,077	22,120	22,161
Lucas	34,620	34,724	34,829	34,971	35,046	35,120	35,193	35,266	35,339	35,408	35,477
Mahoning	19,183	19,251	19,282	19,314	19,349	19,382	19,415	19,446	19,477	19,507	19,535
Medina	13,130	13,188	13,220	13,263	13,293	13,322	13,351	13,379	13,406	13,432	13,459
Miami	9,917	9,937	9,954	9,969	9,980	9,990	10,000	10,010	10,019	10,027	10,035
Summit	39,474	39,637	39,720	39,845	39,942	40,036	40,128	40,219	40,309	40,395	40,478

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:											
	2/22	2/23	2/24	2/25	2/27				3/1				3/3			
Athens	4,550	4,562	4,573	4,594	4,626	(925)	[222]	{111}	4,657	(931)	[224]	{112}	4,687	(937)	[225]	{112}
Cuyahoga	94,021	94,420	94,594	94,867	95,202	(19,040)	[4,570]	{2,285}	95,525	(19,105)	[4,585]	{2,293}	95,836	(19,167)	[4,600]	{2,300}
Franklin	110,653	110,938	111,107	111,312	111,654	(22,331)	[5,359]	{2,680}	111,985	(22,397)	[5,375]	{2,688}	112,299	(22,460)	[5,390]	{2,695}
Hamilton	72,330	72,486	72,643	72,843	73,126	(14,625)	[3,510]	{1,755}	73,393	(14,679)	[3,523]	{1,761}	73,640	(14,728)	[3,535]	{1,767}
Lake	18,087	18,178	18,210	18,273	18,351	(3,670)	[881]	{440}	18,427	(3,685)	[884]	{442}	18,498	(3,700)	[888]	{444}
Lorain	21,667	21,738	21,781	21,846	21,943	(4,389)	[1,053]	{527}	22,034	(4,407)	[1,058]	{529}	22,120	(4,424)	[1,062]	{531}
Lucas	34,620	34,724	34,829	34,971	35,120	(7,024)	[1,686]	{843}	35,266	(7,053)	[1,693]	{846}	35,408	(7,082)	[1,700]	{850}
Mahoning	19,183	19,251	19,282	19,314	19,382	(3,876)	[930]	{465}	19,446	(3,889)	[933]	{467}	19,507	(3,901)	[936]	{468}
Medina	13,130	13,188	13,220	13,263	13,322	(2,664)	[639]	{320}	13,379	(2,676)	[642]	{321}	13,432	(2,686)	[645]	{322}
Miami	9,917	9,937	9,954	9,969	9,990	(1,998)	[480]	{240}	10,010	(2,002)	[480]	{240}	10,027	(2,005)	[481]	{241}
Summit	39,474	39,637	39,720	39,845	40,036	(8,007)	[1,922]	{961}	40,219	(8,044)	[1,931]	{965}	40,395	(8,079)	[1,939]	{969}

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.