

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

Date: 1/28/22

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 1/28/22 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.

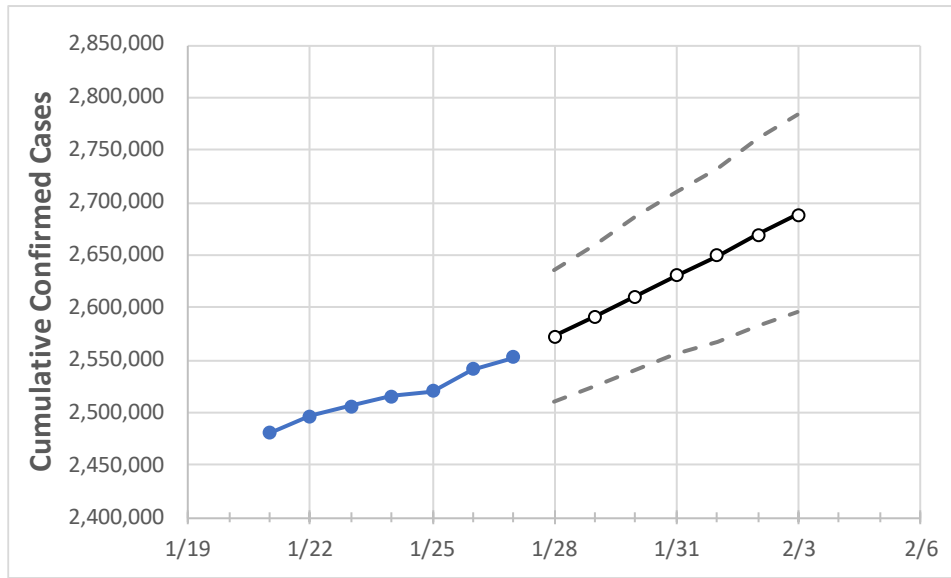
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Ohio	2,515,949	2,520,112	2,540,864	2,552,972	2,572,709	2,591,561	2,610,808	2,630,335	2,649,536	2,669,384	2,688,517

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Athens	12,877	12,895	13,051	13,144	13,337	13,542	13,741	13,948	14,164	14,363	14,578
Cuyahoga	260,667	260,758	261,419	261,856	262,453	263,027	263,526	264,022	264,514	265,003	265,443
Franklin	271,942	272,157	274,393	275,624	277,817	279,934	282,032	284,194	286,359	288,342	290,487
Hamilton	175,809	176,086	177,787	178,654	180,314	181,969	183,507	185,119	186,604	188,296	189,751
Lake	47,591	47,606	47,723	47,803	47,928	48,033	48,145	48,242	48,344	48,445	48,544
Lorain	64,214	64,242	64,456	64,586	64,791	65,002	65,199	65,389	65,576	65,771	65,933
Lucas	93,532	93,610	94,414	94,853	95,682	96,403	97,222	97,985	98,799	99,619	100,276
Mahoning	51,224	51,266	51,498	51,675	51,976	52,266	52,523	52,810	53,079	53,336	53,599
Medina	38,646	38,687	38,848	38,963	39,113	39,259	39,388	39,523	39,649	39,783	39,898
Miami	24,243	24,273	24,532	24,665	24,922	25,189	25,438	25,707	25,966	26,239	26,520
Summit	108,901	108,980	109,293	109,540	109,882	110,238	110,545	110,891	111,181	111,491	111,755

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Athens	12,877	12,895	13,051	13,144	13,542	(2,708)	[650]	{325}	13,948	(2,790)	[670]	{335}	14,363	(2,873)	[689]	{345}
Cuyahoga	260,667	260,758	261,419	261,856	263,027	(52,605)	[12,625]	{6,313}	264,022	(52,804)	[12,673]	{6,337}	265,003	(53,001)	[12,720]	{6,360}
Franklin	271,942	272,157	274,393	275,624	279,934	(55,987)	[13,437]	{6,718}	284,194	(56,839)	[13,641]	{6,821}	288,342	(57,668)	[13,840]	{6,920}
Hamilton	175,809	176,086	177,787	178,654	181,969	(36,394)	[8,735]	{4,367}	185,119	(37,024)	[8,886]	{4,443}	188,296	(37,659)	[9,038]	{4,519}
Lake	47,591	47,606	47,723	47,803	48,033	(9,607)	[2,306]	{1,153}	48,242	(9,648)	[2,316]	{1,158}	48,445	(9,689)	[2,325]	{1,163}
Lorain	64,214	64,242	64,456	64,586	65,002	(13,000)	[3,120]	{1,560}	65,389	(13,078)	[3,139]	{1,569}	65,771	(13,154)	[3,157]	{1,579}
Lucas	93,532	93,610	94,414	94,853	96,403	(19,281)	[4,627]	{2,314}	97,985	(19,597)	[4,703]	{2,352}	99,619	(19,924)	[4,782]	{2,391}
Mahoning	51,224	51,266	51,498	51,675	52,266	(10,453)	[2,509]	{1,254}	52,810	(10,562)	[2,535]	{1,267}	53,336	(10,667)	[2,560]	{1,280}
Medina	38,646	38,687	38,848	38,963	39,259	(7,852)	[1,884]	{942}	39,523	(7,905)	[1,897]	{949}	39,783	(7,957)	[1,910]	{955}
Miami	24,243	24,273	24,532	24,665	25,189	(5,038)	[1,209]	{605}	25,707	(5,141)	[1,234]	{617}	26,239	(5,248)	[1,259]	{630}
Summit	108,901	108,980	109,293	109,540	110,238	(22,048)	[5,291]	{2,646}	110,891	(22,178)	[5,323]	{2,661}	111,491	(22,298)	[5,352]	{2,676}

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.