

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/27/21**

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 12/27/21 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.

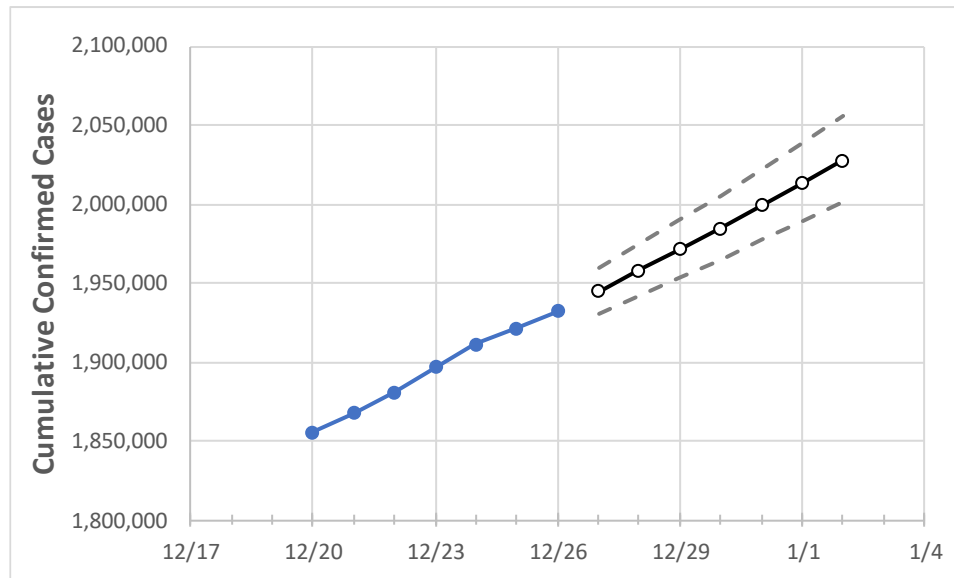
IEM's Modeling Lead

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:							
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	
Ohio	1,896,577	1,910,991	1,921,450	1,931,908	1,944,685	1,957,842	1,971,189	1,984,757	1,998,925	2,013,386	2,027,829	

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:							
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	
Athens	8,833	8,863	8,876	8,889	8,915	8,941	8,968	8,994	9,022	9,049	9,076	
Cuyahoga	206,097	209,787	212,492	215,196	219,144	223,234	227,571	232,023	236,765	241,723	246,788	
Franklin	193,575	195,184	196,319	197,453	198,670	199,898	201,167	202,502	203,827	205,264	206,704	
Hamilton	123,377	124,055	124,542	125,029	125,685	126,335	126,993	127,697	128,385	129,101	129,821	
Lake	37,543	38,115	38,511	38,907	39,400	39,917	40,454	41,013	41,585	42,194	42,823	
Lorain	48,807	49,564	50,069	50,574	51,162	51,793	52,423	53,082	53,772	54,499	55,223	
Lucas	67,958	68,266	68,612	68,958	69,268	69,585	69,897	70,219	70,541	70,878	71,210	
Mahoning	38,965	39,223	39,393	39,562	39,753	39,944	40,137	40,336	40,538	40,745	40,938	
Medina	29,506	29,855	30,106	30,356	30,636	30,924	31,219	31,529	31,841	32,161	32,492	
Miami	18,632	18,714	18,770	18,826	18,893	18,958	19,024	19,090	19,158	19,225	19,292	
Summit	82,603	83,791	84,584	85,376	86,381	87,427	88,487	89,605	90,767	91,974	93,224	

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:											
	12/23	12/24	12/25	12/26	12/28				12/30				1/1			
Athens	8,833	8,863	8,876	8,889	8,941	(1,788)	[429]	{215}	8,994	(1,799)	[432]	{216}	9,049	(1,810)	[434]	{217}
Cuyahoga	206,097	209,787	212,492	215,196	223,234	(44,647)	[10,715]	{5,358}	232,023	(46,405)	[11,137]	{5,569}	241,723	(48,345)	[11,603]	{5,801}
Franklin	193,575	195,184	196,319	197,453	199,898	(39,980)	[9,595]	{4,798}	202,502	(40,500)	[9,720]	{4,860}	205,264	(41,053)	[9,853]	{4,926}
Hamilton	123,377	124,055	124,542	125,029	126,335	(25,267)	[6,064]	{3,032}	127,697	(25,539)	[6,129]	{3,065}	129,101	(25,820)	[6,197]	{3,098}
Lake	37,543	38,115	38,511	38,907	39,917	(7,983)	[1,916]	{958}	41,013	(8,203)	[1,969]	{984}	42,194	(8,439)	[2,025]	{1,013}
Lorain	48,807	49,564	50,069	50,574	51,793	(10,359)	[2,486]	{1,243}	53,082	(10,616)	[2,548]	{1,274}	54,499	(10,900)	[2,616]	{1,308}
Lucas	67,958	68,266	68,612	68,958	69,585	(13,917)	[3,340]	{1,670}	70,219	(14,044)	[3,371]	{1,685}	70,878	(14,176)	[3,402]	{1,701}
Mahoning	38,965	39,223	39,393	39,562	39,944	(7,989)	[1,917]	{959}	40,336	(8,067)	[1,936]	{968}	40,745	(8,149)	[1,956]	{978}
Medina	29,506	29,855	30,106	30,356	30,924	(6,185)	[1,484]	{742}	31,529	(6,306)	[1,513]	{757}	32,161	(6,432)	[1,544]	{772}
Miami	18,632	18,714	18,770	18,826	18,958	(3,792)	[910]	{455}	19,090	(3,818)	[916]	{458}	19,225	(3,845)	[923]	{461}
Summit	82,603	83,791	84,584	85,376	87,427	(17,485)	[4,196]	{2,098}	89,605	(17,921)	[4,301]	{2,151}	91,974	(18,395)	[4,415]	{2,207}

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.