

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/15/21**

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 12/15/21 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.

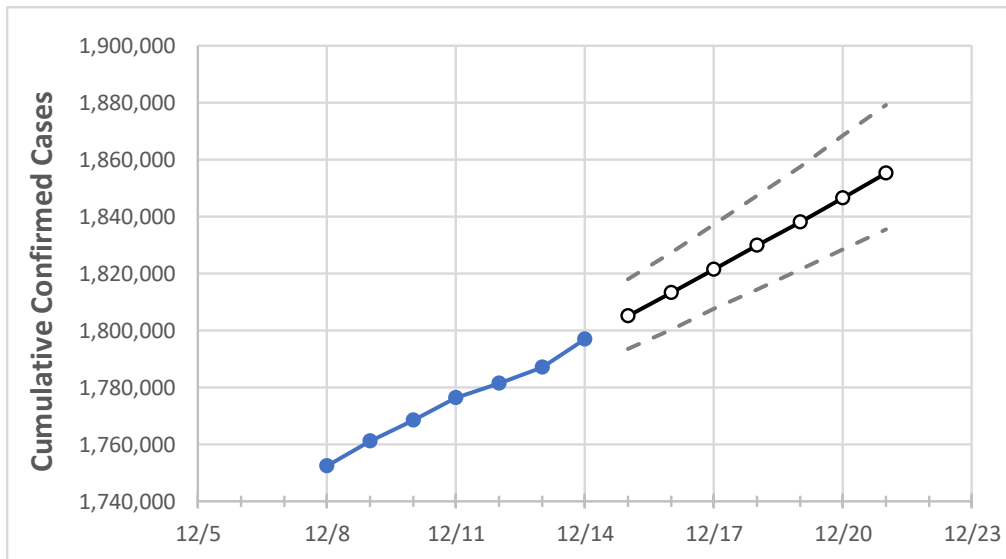
IEM's Modeling Lead

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Ohio	1,776,439	1,781,411	1,787,029	1,796,951	1,805,007	1,813,274	1,821,372	1,829,788	1,838,170	1,846,638	1,855,335

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Athens	8,540	8,548	8,563	8,591	8,612	8,635	8,658	8,680	8,704	8,727	8,752
Cuyahoga	175,914	176,983	177,890	179,268	180,488	181,729	182,995	184,310	185,645	187,027	188,384
Franklin	183,940	184,316	184,748	185,439	186,058	186,681	187,305	187,935	188,591	189,248	189,907
Hamilton	116,608	116,790	117,103	118,417	118,958	119,534	120,089	120,668	121,293	121,946	122,617
Lake	33,777	33,935	34,055	34,279	34,467	34,658	34,845	35,029	35,224	35,412	35,602
Lorain	44,259	44,454	44,609	44,811	45,075	45,336	45,600	45,855	46,130	46,405	46,674
Lucas	65,001	65,169	65,314	65,575	65,822	66,082	66,335	66,590	66,856	67,118	67,379
Mahoning	37,002	37,109	37,199	37,360	37,504	37,648	37,788	37,928	38,070	38,210	38,350
Medina	27,185	27,287	27,363	27,539	27,695	27,850	28,003	28,155	28,312	28,472	28,631
Miami	17,864	17,885	17,977	18,047	18,127	18,210	18,292	18,378	18,467	18,557	18,650
Summit	74,965	75,254	75,540	75,936	76,344	76,742	77,143	77,550	77,966	78,382	78,803

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:											
	12/11	12/12	12/13	12/14	12/16				12/18				12/20			
Athens	8,540	8,548	8,563	8,591	8,635	(1,727)	[414]	{207}	8,680	(1,736)	[417]	{208}	8,727	(1,745)	[419]	{209}
Cuyahoga	175,914	176,983	177,890	179,268	181,729	(36,346)	[8,723]	{4,362}	184,310	(36,862)	[8,847]	{4,423}	187,027	(37,405)	[8,977]	{4,489}
Franklin	183,940	184,316	184,748	185,439	186,681	(37,336)	[8,961]	{4,480}	187,935	(37,587)	[9,021]	{4,510}	189,248	(37,850)	[9,084]	{4,542}
Hamilton	116,608	116,790	117,103	118,417	119,534	(23,907)	[5,738]	{2,869}	120,668	(24,134)	[5,792]	{2,896}	121,946	(24,389)	[5,853]	{2,927}
Lake	33,777	33,935	34,055	34,279	34,658	(6,932)	[1,664]	{832}	35,029	(7,006)	[1,681]	{841}	35,412	(7,082)	[1,700]	{850}
Lorain	44,259	44,454	44,609	44,811	45,336	(9,067)	[2,176]	{1,088}	45,855	(9,171)	[2,201]	{1,101}	46,405	(9,281)	[2,227]	{1,114}
Lucas	65,001	65,169	65,314	65,575	66,082	(13,216)	[3,172]	{1,586}	66,590	(13,318)	[3,196]	{1,598}	67,118	(13,424)	[3,222]	{1,611}
Mahoning	37,002	37,109	37,199	37,360	37,648	(7,530)	[1,807]	{904}	37,928	(7,586)	[1,821]	{910}	38,210	(7,642)	[1,834]	{917}
Medina	27,185	27,287	27,363	27,539	27,850	(5,570)	[1,337]	{668}	28,155	(5,631)	[1,351]	{676}	28,472	(5,694)	[1,367]	{683}
Miami	17,864	17,885	17,977	18,047	18,210	(3,642)	[874]	{437}	18,378	(3,676)	[882]	{441}	18,557	(3,711)	[891]	{445}
Summit	74,965	75,254	75,540	75,936	76,742	(15,348)	[3,684]	{1,842}	77,550	(15,510)	[3,722]	{1,861}	78,382	(15,676)	[3,762]	{1,881}

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.