

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

Date: 12/22/21

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 12/22/21 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.

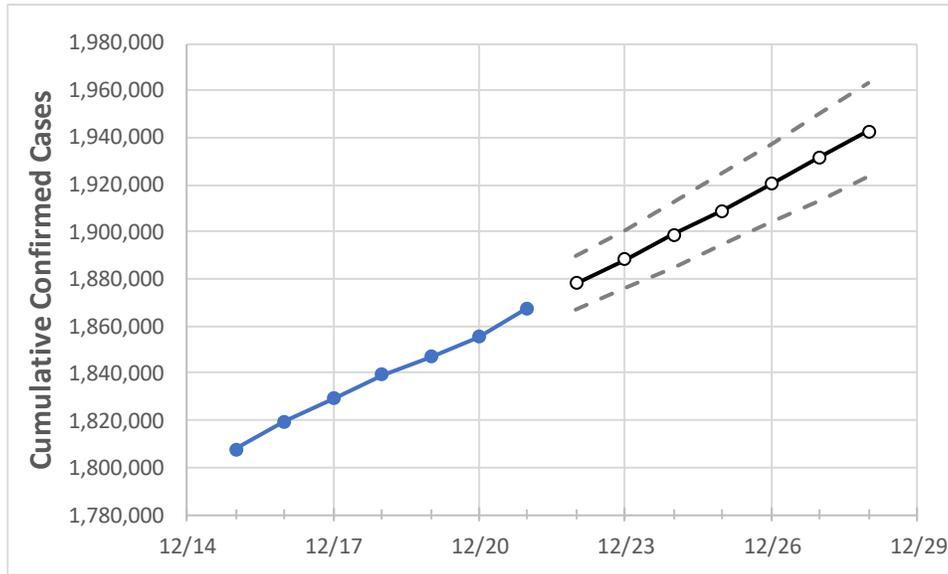
IEM's Modeling Lead

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Ohio	1,839,501	1,847,140	1,855,222	1,867,724	1,878,015	1,888,273	1,898,931	1,909,149	1,920,398	1,931,613	1,942,793

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Athens	8,698	8,716	8,726	8,750	8,774	8,798	8,822	8,845	8,870	8,894	8,920
Cuyahoga	190,171	192,533	195,085	198,647	201,503	204,502	207,633	210,937	214,431	218,041	221,747
Franklin	188,428	189,085	189,624	190,598	191,339	192,093	192,852	193,626	194,420	195,229	196,021
Hamilton	120,875	121,171	121,537	121,972	122,577	123,220	123,874	124,527	125,214	125,949	126,656
Lake	35,418	35,776	36,057	36,498	36,860	37,233	37,624	38,028	38,454	38,889	39,344
Lorain	46,178	46,504	46,814	47,503	47,856	48,229	48,598	48,984	49,365	49,764	50,166
Lucas	66,578	66,731	66,935	67,199	67,434	67,661	67,893	68,125	68,359	68,589	68,821
Mahoning	37,952	38,038	38,241	38,448	38,596	38,749	38,901	39,052	39,204	39,357	39,507
Medina	28,250	28,382	28,550	28,863	29,049	29,238	29,431	29,623	29,823	30,027	30,229
Miami	18,303	18,356	18,406	18,486	18,556	18,627	18,698	18,769	18,842	18,915	18,990
Summit	78,423	78,999	79,589	80,513	81,185	81,866	82,588	83,308	84,067	84,837	85,627

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:											
	12/18	12/19	12/20	12/21	12/23			12/25			12/27					
Athens	8,698	8,716	8,726	8,750	8,798	(1,760)	[422]	{211}	8,845	(1,769)	[425]	{212}	8,894	(1,779)	[427]	{213}
Cuyahoga	190,171	192,533	195,085	198,647	204,502	(40,900)	[9,816]	{4,908}	210,937	(42,187)	[10,125]	{5,062}	218,041	(43,608)	[10,466]	{5,233}
Franklin	188,428	189,085	189,624	190,598	192,093	(38,419)	[9,220]	{4,610}	193,626	(38,725)	[9,294]	{4,647}	195,229	(39,046)	[9,371]	{4,686}
Hamilton	120,875	121,171	121,537	121,972	123,220	(24,644)	[5,915]	{2,957}	124,527	(24,905)	[5,977]	{2,989}	125,949	(25,190)	[6,046]	{3,023}
Lake	35,418	35,776	36,057	36,498	37,233	(7,447)	[1,787]	{894}	38,028	(7,606)	[1,825]	{913}	38,889	(7,778)	[1,867]	{933}
Lorain	46,178	46,504	46,814	47,503	48,229	(9,646)	[2,315]	{1,158}	48,984	(9,797)	[2,351]	{1,176}	49,764	(9,953)	[2,389]	{1,194}
Lucas	66,578	66,731	66,935	67,199	67,661	(13,532)	[3,248]	{1,624}	68,125	(13,625)	[3,270]	{1,635}	68,589	(13,718)	[3,292]	{1,646}
Mahoning	37,952	38,038	38,241	38,448	38,749	(7,750)	[1,860]	{930}	39,052	(7,810)	[1,874]	{937}	39,357	(7,871)	[1,889]	{945}
Medina	28,250	28,382	28,550	28,863	29,238	(5,848)	[1,403]	{702}	29,623	(5,925)	[1,422]	{711}	30,027	(6,005)	[1,441]	{721}
Miami	18,303	18,356	18,406	18,486	18,627	(3,725)	[894]	{447}	18,769	(3,754)	[901]	{450}	18,915	(3,783)	[908]	{454}
Summit	78,423	78,999	79,589	80,513	81,866	(16,373)	[3,930]	{1,965}	83,308	(16,662)	[3,999]	{1,999}	84,837	(16,967)	[4,072]	{2,036}

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.