

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/10/21**

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 12/10/21 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.

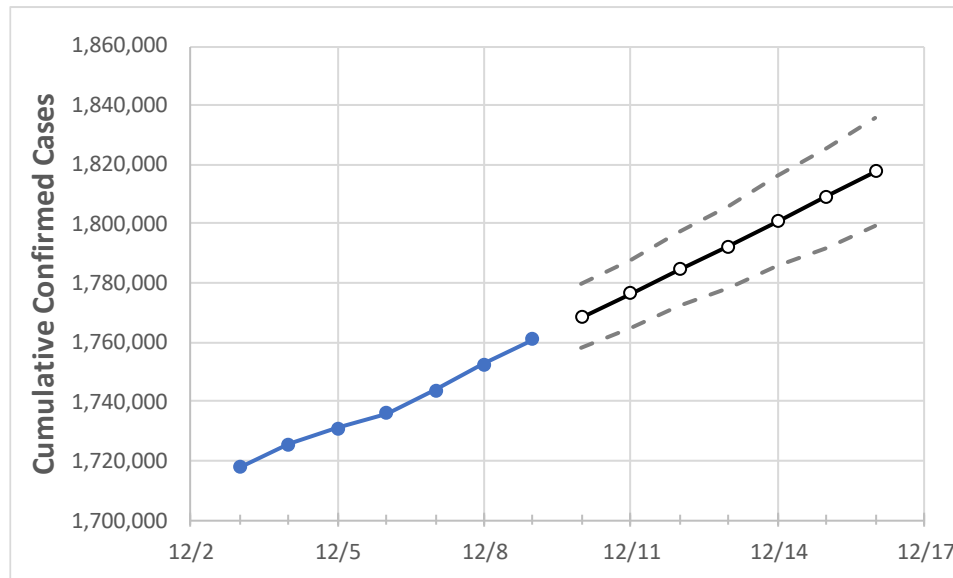
IEM's Modeling Lead

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Ohio	1,735,925	1,743,801	1,752,508	1,761,008	1,768,583	1,776,469	1,784,485	1,792,491	1,800,672	1,809,147	1,817,580

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Athens	8,428	8,449	8,473	8,503	8,525	8,547	8,570	8,594	8,618	8,643	8,669
Cuyahoga	170,504	171,282	172,296	173,515	174,477	175,440	176,437	177,447	178,475	179,533	180,603
Franklin	180,794	181,509	182,134	182,790	183,419	184,066	184,721	185,376	186,075	186,770	187,467
Hamilton	114,644	114,988	115,465	115,850	116,205	116,577	116,947	117,331	117,717	118,124	118,532
Lake	32,818	33,008	33,218	33,408	33,602	33,793	33,988	34,185	34,382	34,581	34,780
Lorain	42,941	43,171	43,467	43,792	44,072	44,351	44,638	44,927	45,223	45,534	45,828
Lucas	63,786	64,042	64,256	64,550	64,818	65,088	65,367	65,644	65,928	66,223	66,515
Mahoning	36,168	36,360	36,524	36,683	36,839	36,994	37,153	37,312	37,469	37,630	37,790
Medina	26,408	26,529	26,704	26,898	27,052	27,213	27,373	27,542	27,706	27,879	28,054
Miami	17,486	17,571	17,654	17,714	17,777	17,838	17,905	17,968	18,035	18,103	18,169
Summit	72,889	73,287	73,703	74,131	74,523	74,914	75,304	75,699	76,106	76,526	76,944

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:											
	12/6	12/7	12/8	12/9	12/11				12/13				12/15			
Athens	8,428	8,449	8,473	8,503	8,547	(1,709)	[410]	{205}	8,594	(1,719)	[413]	{206}	8,643	(1,729)	[415]	{207}
Cuyahoga	170,504	171,282	172,296	173,515	175,440	(35,088)	[8,421]	{4,211}	177,447	(35,489)	[8,517]	{4,259}	179,533	(35,907)	[8,618]	{4,309}
Franklin	180,794	181,509	182,134	182,790	184,066	(36,813)	[8,835]	{4,418}	185,376	(37,075)	[8,898]	{4,449}	186,770	(37,354)	[8,965]	{4,482}
Hamilton	114,644	114,988	115,465	115,850	116,577	(23,315)	[5,596]	{2,798}	117,331	(23,466)	[5,632]	{2,816}	118,124	(23,625)	[5,670]	{2,835}
Lake	32,818	33,008	33,218	33,408	33,793	(6,759)	[1,622]	{811}	34,185	(6,837)	[1,641]	{820}	34,581	(6,916)	[1,660]	{830}
Lorain	42,941	43,171	43,467	43,792	44,351	(8,870)	[2,129]	{1,064}	44,927	(8,985)	[2,157]	{1,078}	45,534	(9,107)	[2,186]	{1,093}
Lucas	63,786	64,042	64,256	64,550	65,088	(13,018)	[3,124]	{1,562}	65,644	(13,129)	[3,151]	{1,575}	66,223	(13,245)	[3,179]	{1,589}
Mahoning	36,168	36,360	36,524	36,683	36,994	(7,399)	[1,776]	{888}	37,312	(7,462)	[1,791]	{895}	37,630	(7,526)	[1,806]	{903}
Medina	26,408	26,529	26,704	26,898	27,213	(5,443)	[1,306]	{653}	27,542	(5,508)	[1,322]	{661}	27,879	(5,576)	[1,338]	{669}
Miami	17,486	17,571	17,654	17,714	17,838	(3,568)	[856]	{428}	17,968	(3,594)	[862]	{431}	18,103	(3,621)	[869]	{434}
Summit	72,889	73,287	73,703	74,131	74,914	(14,983)	[3,596]	{1,798}	75,699	(15,140)	[3,634]	{1,817}	76,526	(15,305)	[3,673]	{1,837}

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.