

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

Date: 9/22/21

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 9/22/21 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.

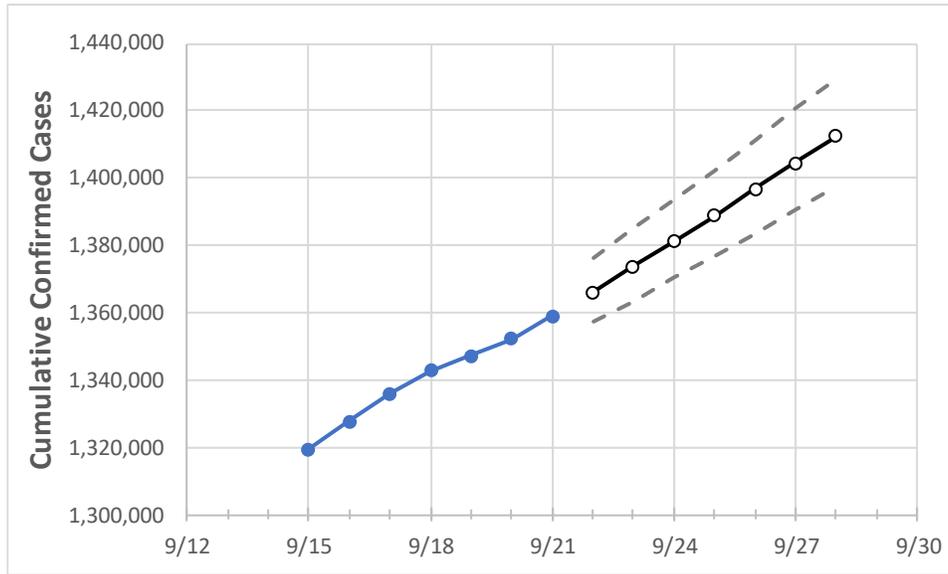
IEM's Modeling Lead

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:							
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	
Ohio	1,342,777	1,347,205	1,352,104	1,358,918	1,366,197	1,373,788	1,381,172	1,388,936	1,396,799	1,404,455	1,412,530	

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:							
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	
Athens	6,810	6,855	6,882	6,933	6,982	7,032	7,081	7,129	7,180	7,231	7,279	
Cuyahoga	132,773	133,138	133,506	133,963	134,464	134,962	135,466	135,983	136,494	137,036	137,571	
Franklin	150,219	150,587	151,037	151,577	152,220	152,870	153,506	154,165	154,841	155,516	156,211	
Hamilton	96,279	96,550	96,791	97,194	97,595	98,000	98,409	98,826	99,242	99,662	100,085	
Lake	24,339	24,390	24,432	24,513	24,595	24,675	24,758	24,841	24,923	25,006	25,091	
Lorain	31,004	31,113	31,241	31,418	31,614	31,816	32,014	32,221	32,434	32,655	32,874	
Lucas	50,248	50,396	50,500	50,677	50,915	51,156	51,393	51,648	51,896	52,159	52,408	
Mahoning	26,462	26,558	26,670	26,831	26,986	27,149	27,312	27,482	27,653	27,828	28,009	
Medina	19,478	19,532	19,634	19,707	19,813	19,921	20,027	20,133	20,242	20,350	20,456	
Miami	13,549	13,594	13,660	13,745	13,830	13,915	14,000	14,086	14,176	14,263	14,352	
Summit	55,514	55,657	55,828	56,008	56,215	56,429	56,637	56,852	57,071	57,292	57,513	

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:											
	9/18	9/19	9/20	9/21	9/23			9/25			9/27					
Athens	6,810	6,855	6,882	6,933	7,032	(1,406)	[338]	{169}	7,129	(1,426)	[342]	{171}	7,231	(1,446)	[347]	{174}
Cuyahoga	132,773	133,138	133,506	133,963	134,962	(26,992)	[6,478]	{3,239}	135,983	(27,197)	[6,527]	{3,264}	137,036	(27,407)	[6,578]	{3,289}
Franklin	150,219	150,587	151,037	151,577	152,870	(30,574)	[7,338]	{3,669}	154,165	(30,833)	[7,400]	{3,700}	155,516	(31,103)	[7,465]	{3,732}
Hamilton	96,279	96,550	96,791	97,194	98,000	(19,600)	[4,704]	{2,352}	98,826	(19,765)	[4,744]	{2,372}	99,662	(19,932)	[4,784]	{2,392}
Lake	24,339	24,390	24,432	24,513	24,675	(4,935)	[1,184]	{592}	24,841	(4,968)	[1,192]	{596}	25,006	(5,001)	[1,200]	{600}
Lorain	31,004	31,113	31,241	31,418	31,816	(6,363)	[1,527]	{764}	32,221	(6,444)	[1,547]	{773}	32,655	(6,531)	[1,567]	{784}
Lucas	50,248	50,396	50,500	50,677	51,156	(10,231)	[2,455]	{1,228}	51,648	(10,330)	[2,479]	{1,240}	52,159	(10,432)	[2,504]	{1,252}
Mahoning	26,462	26,558	26,670	26,831	27,149	(5,430)	[1,303]	{652}	27,482	(5,496)	[1,319]	{660}	27,828	(5,566)	[1,336]	{668}
Medina	19,478	19,532	19,634	19,707	19,921	(3,984)	[956]	{478}	20,133	(4,027)	[966]	{483}	20,350	(4,070)	[977]	{488}
Miami	13,549	13,594	13,660	13,745	13,915	(2,783)	[668]	{334}	14,086	(2,817)	[676]	{338}	14,263	(2,853)	[685]	{342}
Summit	55,514	55,657	55,828	56,008	56,429	(11,286)	[2,709]	{1,354}	56,852	(11,370)	[2,729]	{1,364}	57,292	(11,458)	[2,750]	{1,375}

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.