

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

Date: 11/5/21

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 11/5/21 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.

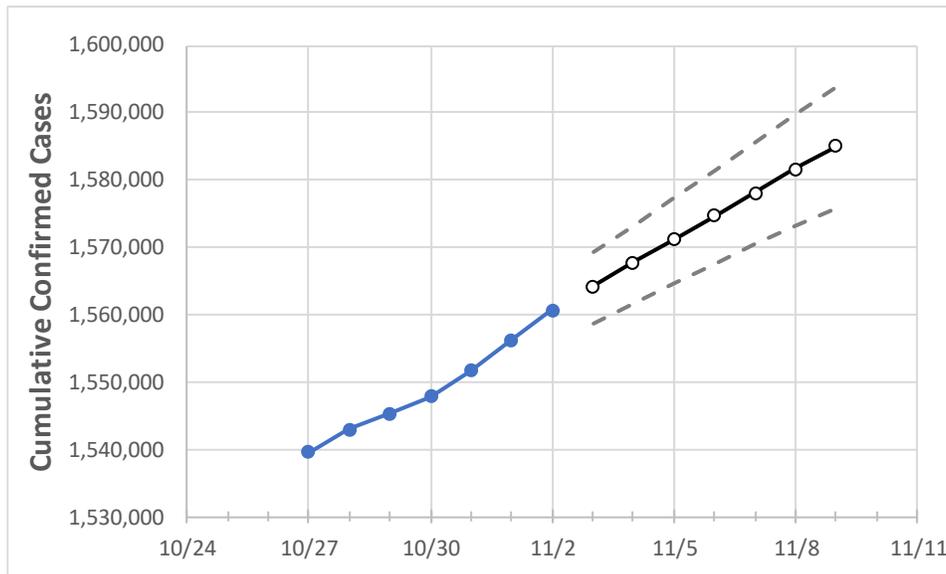
IEM's Modeling Lead

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Ohio	1,547,788	1,551,705	1,556,208	1,560,695	1,564,183	1,567,691	1,571,192	1,574,650	1,578,088	1,581,613	1,585,089	

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Athens	7,891	7,904	7,919	7,928	7,939	7,951	7,961	7,972	7,983	7,993	8,003	
Cuyahoga	148,981	149,334	149,715	150,149	150,484	150,825	151,170	151,519	151,870	152,224	152,570	
Franklin	166,478	166,762	167,105	167,410	167,665	167,926	168,175	168,425	168,695	168,943	169,201	
Hamilton	106,631	106,773	106,962	107,158	107,312	107,466	107,618	107,773	107,929	108,081	108,237	
Lake	27,710	27,791	27,896	27,992	28,076	28,160	28,245	28,331	28,416	28,503	28,589	
Lorain	36,469	36,549	36,686	36,841	36,947	37,052	37,156	37,260	37,367	37,473	37,582	
Lucas	57,359	57,484	57,646	57,801	57,918	58,035	58,152	58,267	58,384	58,498	58,609	
Mahoning	31,450	31,550	31,663	31,772	31,848	31,926	32,004	32,082	32,160	32,239	32,313	
Medina	22,555	22,623	22,697	22,802	22,870	22,938	23,008	23,079	23,150	23,224	23,293	
Miami	15,910	15,947	15,990	16,061	16,102	16,142	16,183	16,223	16,263	16,306	16,344	
Summit	63,007	63,198	63,373	63,578	63,739	63,893	64,055	64,213	64,375	64,536	64,698	

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:											
	10/30	10/31	11/1	11/2	11/4			11/6			11/8					
Athens	7,891	7,904	7,919	7,928	7,951	(1,590)	[382]	{191}	7,972	(1,594)	[383]	{191}	7,993	(1,599)	[384]	{192}
Cuyahoga	148,981	149,334	149,715	150,149	150,825	(30,165)	[7,240]	{3,620}	151,519	(30,304)	[7,273]	{3,636}	152,224	(30,445)	[7,307]	{3,653}
Franklin	166,478	166,762	167,105	167,410	167,926	(33,585)	[8,060]	{4,030}	168,425	(33,685)	[8,084]	{4,042}	168,943	(33,789)	[8,109]	{4,055}
Hamilton	106,631	106,773	106,962	107,158	107,466	(21,493)	[5,158]	{2,579}	107,773	(21,555)	[5,173]	{2,587}	108,081	(21,616)	[5,188]	{2,594}
Lake	27,710	27,791	27,896	27,992	28,160	(5,632)	[1,352]	{676}	28,331	(5,666)	[1,360]	{680}	28,503	(5,701)	[1,368]	{684}
Lorain	36,469	36,549	36,686	36,841	37,052	(7,410)	[1,778]	{889}	37,260	(7,452)	[1,789]	{894}	37,473	(7,495)	[1,799]	{899}
Lucas	57,359	57,484	57,646	57,801	58,035	(11,607)	[2,786]	{1,393}	58,267	(11,653)	[2,797]	{1,398}	58,498	(11,700)	[2,808]	{1,404}
Mahoning	31,450	31,550	31,663	31,772	31,926	(6,385)	[1,532]	{766}	32,082	(6,416)	[1,540]	{770}	32,239	(6,448)	[1,547]	{774}
Medina	22,555	22,623	22,697	22,802	22,938	(4,588)	[1,101]	{551}	23,079	(4,616)	[1,108]	{554}	23,224	(4,645)	[1,115]	{557}
Miami	15,910	15,947	15,990	16,061	16,142	(3,228)	[775]	{387}	16,223	(3,245)	[779]	{389}	16,306	(3,261)	[783]	{391}
Summit	63,007	63,198	63,373	63,578	63,893	(12,779)	[3,067]	{1,533}	64,213	(12,843)	[3,082]	{1,541}	64,536	(12,907)	[3,098]	{1,549}

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.