

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

Date: 11/24/20

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 11/24/20 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.

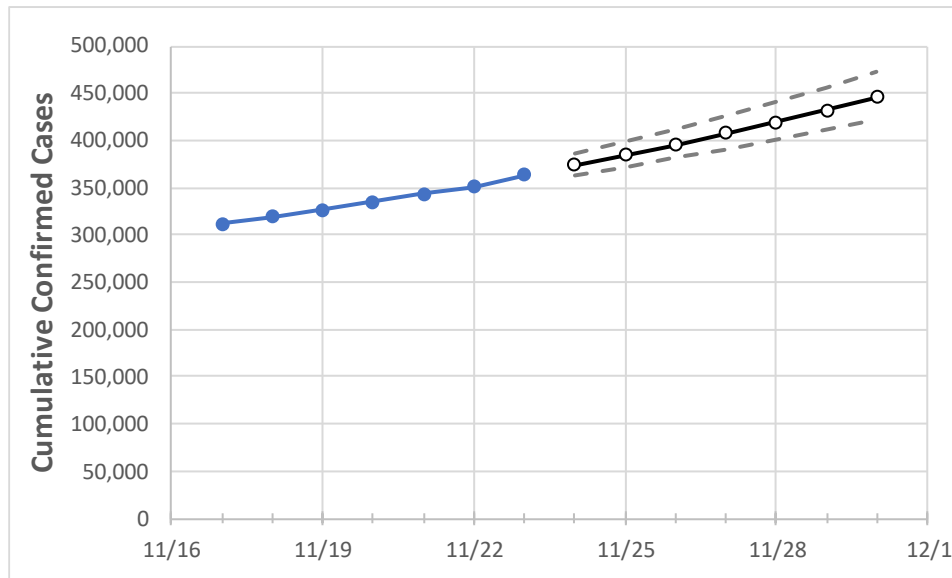
IEM's Modeling Lead

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:					
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Ohio	335,423	343,286	351,419	363,304	373,675	384,478	395,729	407,446	419,646	432,349	445,571

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 20%, and are often within 10%, of actual confirmed cases.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30	
Cuyahoga	32,296	32,905	34,096	35,214	36,304	37,458	38,678	39,969	41,335	42,779	44,306	
Franklin	46,473	47,321	48,389	49,267	50,265	51,300	52,374	53,488	54,643	55,842	57,085	
Hamilton	27,724	28,270	28,674	29,462	30,173	30,913	31,681	32,479	33,308	34,168	35,062	
Lake	5,861	5,991	6,254	6,627	6,958	7,307	7,673	8,059	8,464	8,890	9,338	
Lorain	5,565	5,644	5,902	6,236	6,501	6,783	7,085	7,408	7,752	8,120	8,512	
Lucas	13,035	13,263	13,446	14,033	14,376	14,735	15,112	15,508	15,922	16,357	16,813	
Mahoning	6,459	6,643	6,772	7,068	7,326	7,603	7,899	8,215	8,553	8,914	9,299	
Medina	3,875	3,941	4,133	4,286	4,430	4,580	4,738	4,902	5,074	5,253	5,441	
Miami	3,813	3,875	3,985	4,164	4,288	4,418	4,554	4,696	4,844	4,999	5,161	
Summit	11,890	12,143	12,431	12,962	13,366	13,792	14,239	14,709	15,204	15,723	16,269	

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:											
	11/20	11/21	11/22	11/23	11/25				11/27				11/29			
Cuyahoga	32,296	32,905	34,096	35,214	37,458	(7,492)	[1,798]	{899}	39,969	(7,994)	[1,919]	{959}	42,779	(8,556)	[2,053]	{1,027}
Franklin	46,473	47,321	48,389	49,267	51,300	(10,260)	[2,462]	{1,231}	53,488	(10,698)	[2,567]	{1,284}	55,842	(11,168)	[2,680]	{1,340}
Hamilton	27,724	28,270	28,674	29,462	30,913	(6,183)	[1,484]	{742}	32,479	(6,496)	[1,559]	{779}	34,168	(6,834)	[1,640]	{820}
Lake	5,861	5,991	6,254	6,627	7,307	(1,461)	[351]	{175}	8,059	(1,612)	[387]	{193}	8,890	(1,778)	[427]	{213}
Lorain	5,565	5,644	5,902	6,236	6,783	(1,357)	[326]	{163}	7,408	(1,482)	[356]	{178}	8,120	(1,624)	[390]	{195}
Lucas	13,035	13,263	13,446	14,033	14,735	(2,947)	[707]	{354}	15,508	(3,102)	[744]	{372}	16,357	(3,271)	[785]	{393}
Mahoning	6,459	6,643	6,772	7,068	7,603	(1,521)	[365]	{182}	8,215	(1,643)	[394]	{197}	8,914	(1,783)	[428]	{214}
Medina	3,875	3,941	4,133	4,286	4,580	(916)	[220]	{110}	4,902	(980)	[235]	{118}	5,253	(1,051)	[252]	{126}
Miami	3,813	3,875	3,985	4,164	4,418	(884)	[212]	{106}	4,696	(939)	[225]	{113}	4,999	(1,000)	[240]	{120}
Summit	11,890	12,143	12,431	12,962	13,792	(2,758)	[662]	{331}	14,709	(2,942)	[706]	{353}	15,723	(3,145)	[755]	{377}

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.