

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/15/20**

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 12/15/20 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.

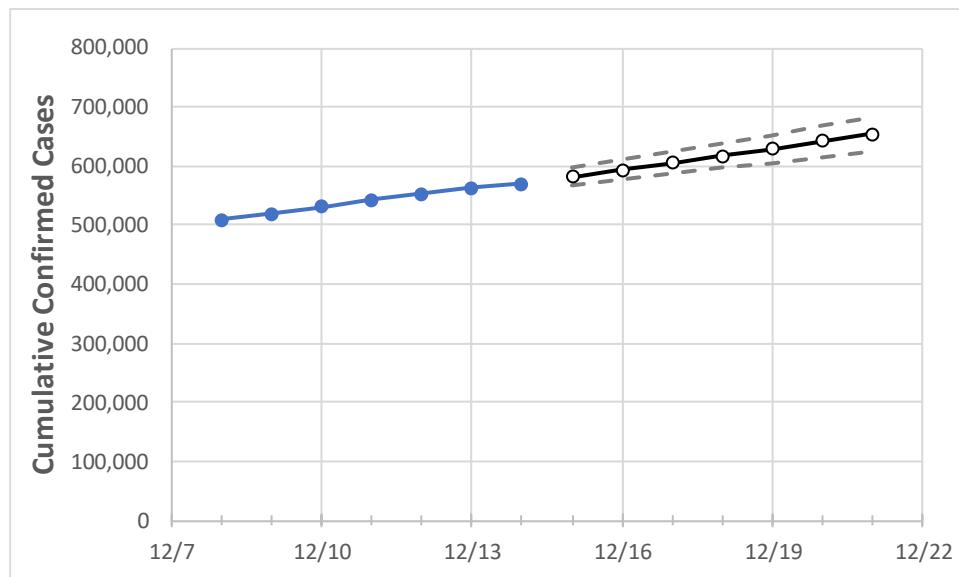
IEM's Modeling Lead

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:							
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	
Ohio	542,209	553,461	562,727	570,602	582,188	593,896	605,727	617,680	629,757	641,956	654,279	

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:							
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	
Athens	2,565	2,598	2,629	2,653	2,694	2,735	2,777	2,819	2,860	2,902	2,945	
Cuyahoga	53,832	55,093	56,505	57,303	58,667	60,066	61,499	62,968	64,472	66,013	67,591	
Franklin	67,043	68,157	69,074	69,961	71,167	72,386	73,621	74,870	76,134	77,413	78,706	
Hamilton	41,545	42,448	43,008	43,457	44,269	45,094	45,931	46,781	47,643	48,518	49,406	
Lake	9,860	10,032	10,207	10,332	10,481	10,628	10,774	10,919	11,062	11,203	11,343	
Lorain	10,874	11,143	11,410	11,648	11,980	12,318	12,665	13,019	13,380	13,749	14,127	
Lucas	20,510	20,916	21,239	21,577	22,024	22,481	22,946	23,421	23,906	24,399	24,903	
Mahoning	11,297	11,508	11,716	11,852	12,115	12,381	12,649	12,921	13,195	13,471	13,751	
Medina	6,983	7,122	7,297	7,407	7,566	7,727	7,890	8,053	8,218	8,385	8,553	
Miami	6,032	6,122	6,203	6,256	6,353	6,450	6,546	6,642	6,737	6,833	6,928	
Summit	20,931	21,501	21,898	22,244	22,803	23,374	23,957	24,551	25,157	25,776	26,406	

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:				12/20
	12/11	12/12	12/13	12/14	12/16	12/18	12/20	12/20	
Athens	2,565	2,598	2,629	2,653	2,735 (547) [131] {66}	2,819 (564) [135] {68}	2,902 (580) [139] {70}		
Cuyahoga	53,832	55,093	56,505	57,303	60,066 (12,013) [2,883] {1,442}	62,968 (12,594) [3,022] {1,511}	66,013 (13,203) [3,169] {1,584}		
Franklin	67,043	68,157	69,074	69,961	72,386 (14,477) [3,475] {1,737}	74,870 (14,974) [3,594] {1,797}	77,413 (15,483) [3,716] {1,858}		
Hamilton	41,545	42,448	43,008	43,457	45,094 (9,019) [2,165] {1,082}	46,781 (9,356) [2,245] {1,123}	48,518 (9,704) [2,329] {1,164}		
Lake	9,860	10,032	10,207	10,332	10,628 (2,126) [510] {255}	10,919 (2,184) [524] {262}	11,203 (2,241) [538] {269}		
Lorain	10,874	11,143	11,410	11,648	12,318 (2,464) [591] {296}	13,019 (2,604) [625] {312}	13,749 (2,750) [660] {330}		
Lucas	20,510	20,916	21,239	21,577	22,481 (4,496) [1,079] {540}	23,421 (4,684) [1,124] {562}	24,399 (4,880) [1,171] {586}		
Mahoning	11,297	11,508	11,716	11,852	12,381 (2,476) [594] {297}	12,921 (2,584) [620] {310}	13,471 (2,694) [647] {323}		
Medina	6,983	7,122	7,297	7,407	7,727 (1,545) [371] {185}	8,053 (1,611) [387] {193}	8,385 (1,677) [402] {201}		
Miami	6,032	6,122	6,203	6,256	6,450 (1,290) [310] {155}	6,642 (1,328) [319] {159}	6,833 (1,367) [328] {164}		
Summit	20,931	21,501	21,898	22,244	23,374 (4,675) [1,122] {561}	24,551 (4,910) [1,178] {589}	25,776 (5,155) [1,237] {619}		

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.