

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 4/22/21**

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 4/22/21 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.

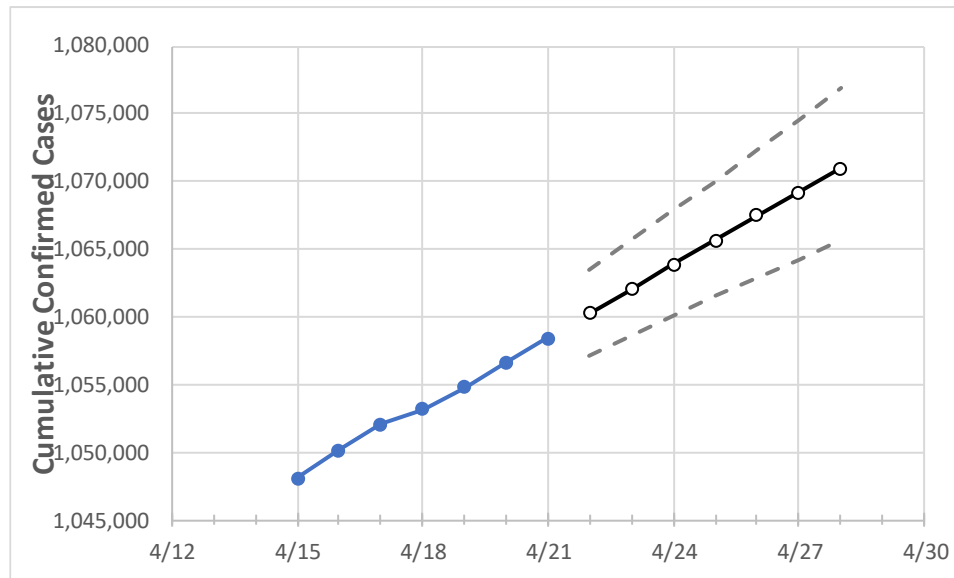
IEM's Modeling Lead

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Ohio	1,053,175	1,054,807	1,056,606	1,058,395	1,060,225	1,062,034	1,063,851	1,065,681	1,067,480	1,069,220	1,071,001

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Athens	5,024	5,038	5,070	5,092	5,110	5,129	5,149	5,169	5,190	5,212	5,235	
Cuyahoga	107,210	107,459	107,687	108,004	108,294	108,580	108,870	109,161	109,449	109,736	110,020	
Franklin	122,299	122,519	122,789	122,998	123,237	123,471	123,710	123,945	124,177	124,414	124,646	
Hamilton	78,220	78,326	78,409	78,503	78,600	78,697	78,793	78,890	78,985	79,080	79,177	
Lake	20,038	20,067	20,100	20,143	20,184	20,225	20,266	20,306	20,347	20,386	20,426	
Lorain	24,190	24,246	24,284	24,333	24,387	24,441	24,493	24,546	24,599	24,652	24,705	
Lucas	40,200	40,298	40,405	40,568	40,706	40,847	40,988	41,129	41,275	41,415	41,560	
Mahoning	20,915	20,946	20,991	21,029	21,065	21,102	21,138	21,175	21,211	21,248	21,283	
Medina	14,898	14,922	14,944	14,961	14,984	15,007	15,029	15,051	15,071	15,091	15,111	
Miami	10,541	10,548	10,556	10,568	10,578	10,589	10,599	10,609	10,619	10,628	10,638	
Summit	45,464	45,557	45,630	45,710	45,811	45,911	46,010	46,104	46,199	46,291	46,382	

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:											
	4/18	4/19	4/20	4/21	4/23				4/25				4/27			
Athens	5,024	5,038	5,070	5,092	5,129	(1,026)	[246]	{123}	5,169	(1,034)	[248]	{124}	5,212	(1,042)	[250]	{125}
Cuyahoga	107,210	107,459	107,687	108,004	108,580	(21,716)	[5,212]	{2,606}	109,161	(21,832)	[5,240]	{2,620}	109,736	(21,947)	[5,267]	{2,634}
Franklin	122,299	122,519	122,789	122,998	123,471	(24,694)	[5,927]	{2,963}	123,945	(24,789)	[5,949]	{2,975}	124,414	(24,883)	[5,972]	{2,986}
Hamilton	78,220	78,326	78,409	78,503	78,697	(15,739)	[3,777]	{1,889}	78,890	(15,778)	[3,787]	{1,893}	79,080	(15,816)	[3,796]	{1,898}
Lake	20,038	20,067	20,100	20,143	20,225	(4,045)	[971]	{485}	20,306	(4,061)	[975]	{487}	20,386	(4,077)	[979]	{489}
Lorain	24,190	24,246	24,284	24,333	24,441	(4,888)	[1,173]	{587}	24,546	(4,909)	[1,178]	{589}	24,652	(4,930)	[1,183]	{592}
Lucas	40,200	40,298	40,405	40,568	40,847	(8,169)	[1,961]	{980}	41,129	(8,226)	[1,974]	{987}	41,415	(8,283)	[1,988]	{994}
Mahoning	20,915	20,946	20,991	21,029	21,102	(4,220)	[1,013]	{506}	21,175	(4,235)	[1,016]	{508}	21,248	(4,250)	[1,020]	{510}
Medina	14,898	14,922	14,944	14,961	15,007	(3,001)	[720]	{360}	15,051	(3,010)	[722]	{361}	15,091	(3,018)	[724]	{362}
Miami	10,541	10,548	10,556	10,568	10,589	(2,118)	[508]	{254}	10,609	(2,122)	[509]	{255}	10,628	(2,126)	[510]	{255}
Summit	45,464	45,557	45,630	45,710	45,911	(9,182)	[2,204]	{1,102}	46,104	(9,221)	[2,213]	{1,107}	46,291	(9,258)	[2,222]	{1,111}

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.