

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

Date: 1/5/21

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 1/5/21 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.

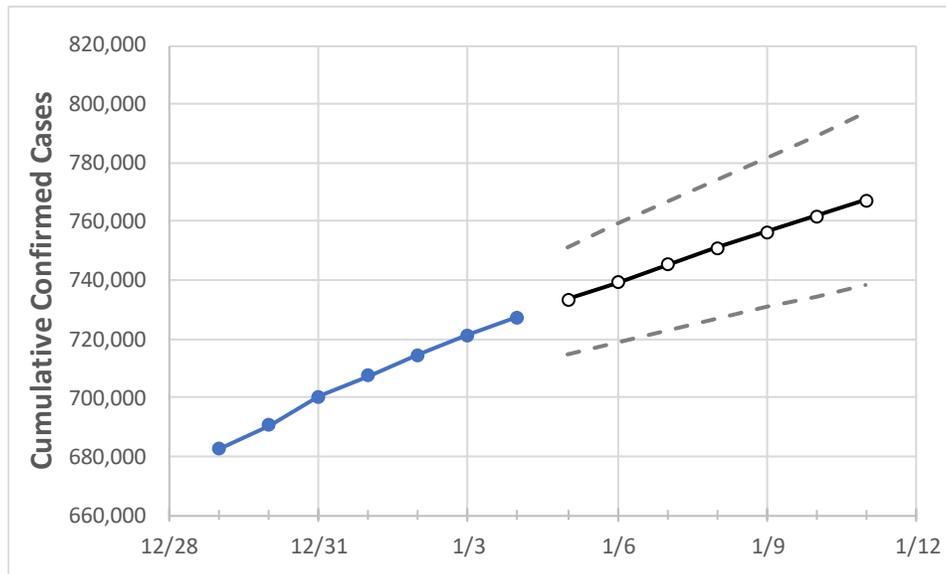
IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Ohio	707,527	714,673	721,481	727,423	733,443	739,279	745,136	750,953	756,391	761,918	767,320

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Athens	3,124	3,146	3,171	3,190	3,212	3,233	3,254	3,274	3,294	3,315	3,336
Cuyahoga	70,940	71,742	72,520	73,116	73,777	74,432	75,084	75,719	76,350	76,981	77,610
Franklin	84,802	85,553	86,446	87,106	87,798	88,488	89,161	89,835	90,483	91,129	91,766
Hamilton	52,334	52,847	53,404	53,797	54,210	54,617	55,028	55,424	55,821	56,215	56,607
Lake	12,885	13,013	13,156	13,317	13,451	13,584	13,718	13,851	13,983	14,115	14,244
Lorain	15,009	15,231	15,421	15,622	15,810	15,997	16,189	16,381	16,575	16,767	16,959
Lucas	26,075	26,344	26,509	26,742	26,943	27,144	27,343	27,539	27,725	27,917	28,107
Mahoning	14,924	15,047	15,131	15,269	15,390	15,511	15,631	15,745	15,857	15,966	16,080
Medina	9,414	9,515	9,601	9,700	9,787	9,874	9,958	10,042	10,123	10,203	10,283
Miami	7,677	7,773	7,841	7,872	7,936	7,999	8,059	8,122	8,181	8,240	8,298
Summit	28,290	28,539	28,782	29,030	29,271	29,499	29,728	29,947	30,168	30,387	30,596

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:											
	1/1	1/2	1/3	1/4	1/6				1/8				1/10			
Athens	3,124	3,146	3,171	3,190	3,233	(647)	[155]	{78}	3,274	(655)	[157]	{79}	3,315	(663)	[159]	{80}
Cuyahoga	70,940	71,742	72,520	73,116	74,432	(14,886)	[3,573]	{1,786}	75,719	(15,144)	[3,635]	{1,817}	76,981	(15,396)	[3,695]	{1,848}
Franklin	84,802	85,553	86,446	87,106	88,488	(17,698)	[4,247]	{2,124}	89,835	(17,967)	[4,312]	{2,156}	91,129	(18,226)	[4,374]	{2,187}
Hamilton	52,334	52,847	53,404	53,797	54,617	(10,923)	[2,622]	{1,311}	55,424	(11,085)	[2,660]	{1,330}	56,215	(11,243)	[2,698]	{1,349}
Lake	12,885	13,013	13,156	13,317	13,584	(2,717)	[652]	{326}	13,851	(2,770)	[665]	{332}	14,115	(2,823)	[677]	{339}
Lorain	15,009	15,231	15,421	15,622	15,997	(3,199)	[768]	{384}	16,381	(3,276)	[786]	{393}	16,767	(3,353)	[805]	{402}
Lucas	26,075	26,344	26,509	26,742	27,144	(5,429)	[1,303]	{651}	27,539	(5,508)	[1,322]	{661}	27,917	(5,583)	[1,340]	{670}
Mahoning	14,924	15,047	15,131	15,269	15,511	(3,102)	[745]	{372}	15,745	(3,149)	[756]	{378}	15,966	(3,193)	[766]	{383}
Medina	9,414	9,515	9,601	9,700	9,874	(1,975)	[474]	{237}	10,042	(2,008)	[482]	{241}	10,203	(2,041)	[490]	{245}
Miami	7,677	7,773	7,841	7,872	7,999	(1,600)	[384]	{192}	8,122	(1,624)	[390]	{195}	8,240	(1,648)	[396]	{198}
Summit	28,290	28,539	28,782	29,030	29,499	(5,900)	[1,416]	{708}	29,947	(5,989)	[1,437]	{719}	30,387	(6,077)	[1,459]	{729}

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.