

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

Date: 1/21/21

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 1/21/21 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.

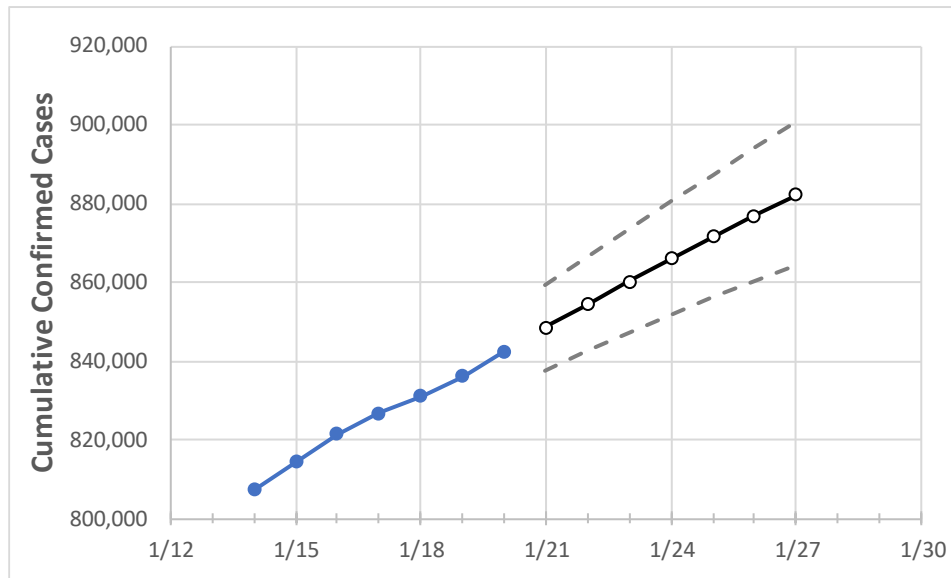
IEM's Modeling Lead

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Ohio	826,754	831,066	836,049	842,433	848,500	854,432	860,169	865,934	871,469	876,875	882,256

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Athens	3,636	3,654	3,675	3,707	3,739	3,770	3,802	3,833	3,864	3,896	3,927
Cuyahoga	82,178	82,613	83,180	83,770	84,396	85,011	85,622	86,213	86,804	87,385	87,948
Franklin	97,493	97,996	98,533	99,253	99,957	100,646	101,339	102,007	102,668	103,319	103,979
Hamilton	61,350	61,629	61,931	62,391	62,890	63,386	63,868	64,349	64,832	65,300	65,771
Lake	15,365	15,491	15,592	15,747	15,885	16,019	16,151	16,282	16,413	16,540	16,668
Lorain	18,086	18,217	18,418	18,599	18,780	18,960	19,141	19,315	19,493	19,670	19,844
Lucas	30,111	30,316	30,524	30,760	30,993	31,221	31,446	31,673	31,893	32,109	32,326
Mahoning	16,758	16,815	16,931	17,035	17,128	17,224	17,315	17,406	17,497	17,587	17,673
Medina	11,128	11,191	11,286	11,364	11,458	11,552	11,644	11,735	11,824	11,913	11,999
Miami	8,865	8,905	8,952	8,999	9,059	9,119	9,177	9,236	9,293	9,348	9,406
Summit	33,399	33,603	33,849	34,150	34,460	34,769	35,070	35,376	35,687	36,003	36,292

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:											
	1/17	1/18	1/19	1/20	1/22				1/24				1/26			
Athens	3,636	3,654	3,675	3,707	3,770	(754)	[181]	{90}	3,833	(767)	[184]	{92}	3,896	(779)	[187]	{93}
Cuyahoga	82,178	82,613	83,180	83,770	85,011	(17,002)	[4,081]	{2,040}	86,213	(17,243)	[4,138]	{2,069}	87,385	(17,477)	[4,194]	{2,097}
Franklin	97,493	97,996	98,533	99,253	100,646	(20,129)	[4,831]	{2,416}	102,007	(20,401)	[4,896]	{2,448}	103,319	(20,664)	[4,959]	{2,480}
Hamilton	61,350	61,629	61,931	62,391	63,386	(12,677)	[3,043]	{1,521}	64,349	(12,870)	[3,089]	{1,544}	65,300	(13,060)	[3,134]	{1,567}
Lake	15,365	15,491	15,592	15,747	16,019	(3,204)	[769]	{384}	16,282	(3,256)	[782]	{391}	16,540	(3,308)	[794]	{397}
Lorain	18,086	18,217	18,418	18,599	18,960	(3,792)	[910]	{455}	19,315	(3,863)	[927]	{464}	19,670	(3,934)	[944]	{472}
Lucas	30,111	30,316	30,524	30,760	31,221	(6,244)	[1,499]	{749}	31,673	(6,335)	[1,520]	{760}	32,109	(6,422)	[1,541]	{771}
Mahoning	16,758	16,815	16,931	17,035	17,224	(3,445)	[827]	{413}	17,406	(3,481)	[836]	{418}	17,587	(3,517)	[844]	{422}
Medina	11,128	11,191	11,286	11,364	11,552	(2,310)	[554]	{277}	11,735	(2,347)	[563]	{282}	11,913	(2,383)	[572]	{286}
Miami	8,865	8,905	8,952	8,999	9,119	(1,824)	[438]	{219}	9,236	(1,847)	[443]	{222}	9,348	(1,870)	[449]	{224}
Summit	33,399	33,603	33,849	34,150	34,769	(6,954)	[1,669]	{834}	35,376	(7,075)	[1,698]	{849}	36,003	(7,201)	[1,728]	{864}

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.