

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

Date: 4/12/21

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 4/12/21 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.

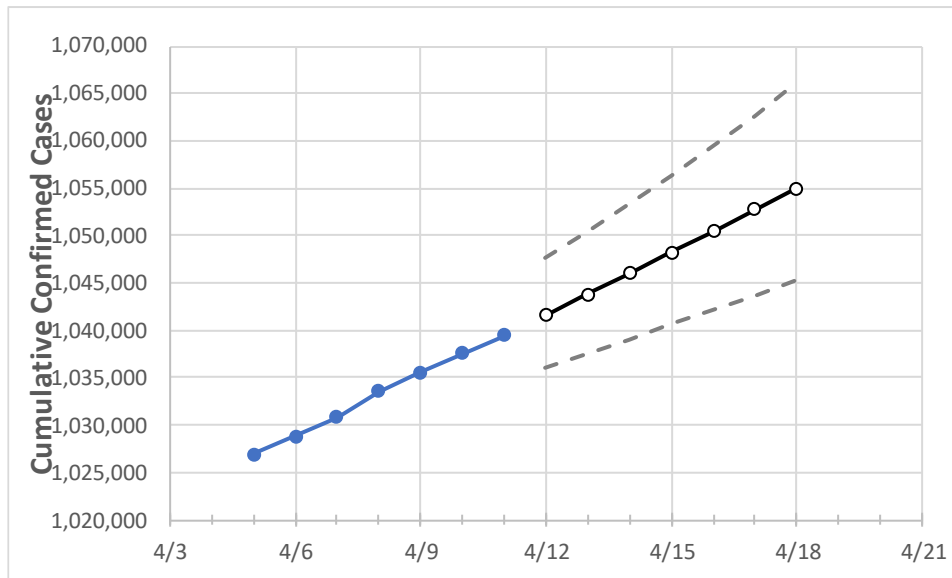
IEM's Modeling Lead

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Ohio	1,033,606	1,035,552	1,037,600	1,039,455	1,041,610	1,043,784	1,045,979	1,048,199	1,050,468	1,052,738	1,055,041

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Athens	4,911	4,917	4,936	4,948	4,961	4,974	4,987	5,001	5,016	5,031	5,046
Cuyahoga	104,290	104,537	104,849	105,180	105,512	105,850	106,191	106,540	106,905	107,281	107,654
Franklin	119,897	120,142	120,346	120,536	120,801	121,062	121,330	121,598	121,869	122,140	122,425
Hamilton	77,213	77,329	77,422	77,499	77,600	77,701	77,801	77,901	78,002	78,102	78,200
Lake	19,603	19,651	19,698	19,760	19,819	19,881	19,945	20,011	20,081	20,153	20,228
Lorain	23,670	23,710	23,775	23,831	23,892	23,953	24,015	24,078	24,141	24,205	24,269
Lucas	38,790	38,950	39,105	39,235	39,377	39,522	39,671	39,824	39,980	40,139	40,305
Mahoning	20,543	20,587	20,622	20,653	20,695	20,737	20,781	20,826	20,871	20,918	20,967
Medina	14,601	14,630	14,662	14,693	14,723	14,753	14,783	14,814	14,844	14,874	14,904
Miami	10,426	10,436	10,455	10,470	10,482	10,495	10,507	10,520	10,533	10,546	10,559
Summit	44,226	44,336	44,494	44,613	44,744	44,877	45,013	45,148	45,286	45,425	45,563

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:											
	4/8	4/9	4/10	4/11	4/13			4/15			4/17					
Athens	4,911	4,917	4,936	4,948	4,974	(995)	[239]	{119}	5,001	(1,000)	[240]	{120}	5,031	(1,006)	[241]	{121}
Cuyahoga	104,290	104,537	104,849	105,180	105,850	(21,170)	[5,081]	{2,540}	106,540	(21,308)	[5,114]	{2,557}	107,281	(21,456)	[5,149]	{2,575}
Franklin	119,897	120,142	120,346	120,536	121,062	(24,212)	[5,811]	{2,905}	121,598	(24,320)	[5,837]	{2,918}	122,140	(24,428)	[5,863]	{2,931}
Hamilton	77,213	77,329	77,422	77,499	77,701	(15,540)	[3,730]	{1,865}	77,901	(15,580)	[3,739]	{1,870}	78,102	(15,620)	[3,749]	{1,874}
Lake	19,603	19,651	19,698	19,760	19,881	(3,976)	[954]	{477}	20,011	(4,002)	[961]	{480}	20,153	(4,031)	[967]	{484}
Lorain	23,670	23,710	23,775	23,831	23,953	(4,791)	[1,150]	{575}	24,078	(4,816)	[1,156]	{578}	24,205	(4,841)	[1,162]	{581}
Lucas	38,790	38,950	39,105	39,235	39,522	(7,904)	[1,897]	{949}	39,824	(7,965)	[1,912]	{956}	40,139	(8,028)	[1,927]	{963}
Mahoning	20,543	20,587	20,622	20,653	20,737	(4,147)	[995]	{498}	20,826	(4,165)	[1,000]	{500}	20,918	(4,184)	[1,004]	{502}
Medina	14,601	14,630	14,662	14,693	14,753	(2,951)	[708]	{354}	14,814	(2,963)	[711]	{356}	14,874	(2,975)	[714]	{357}
Miami	10,426	10,436	10,455	10,470	10,495	(2,099)	[504]	{252}	10,520	(2,104)	[505]	{252}	10,546	(2,109)	[506]	{253}
Summit	44,226	44,336	44,494	44,613	44,877	(8,975)	[2,154]	{1,077}	45,148	(9,030)	[2,167]	{1,084}	45,425	(9,085)	[2,180]	{1,090}

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.