

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

Date: 3/17/21

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 3/17/21 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.

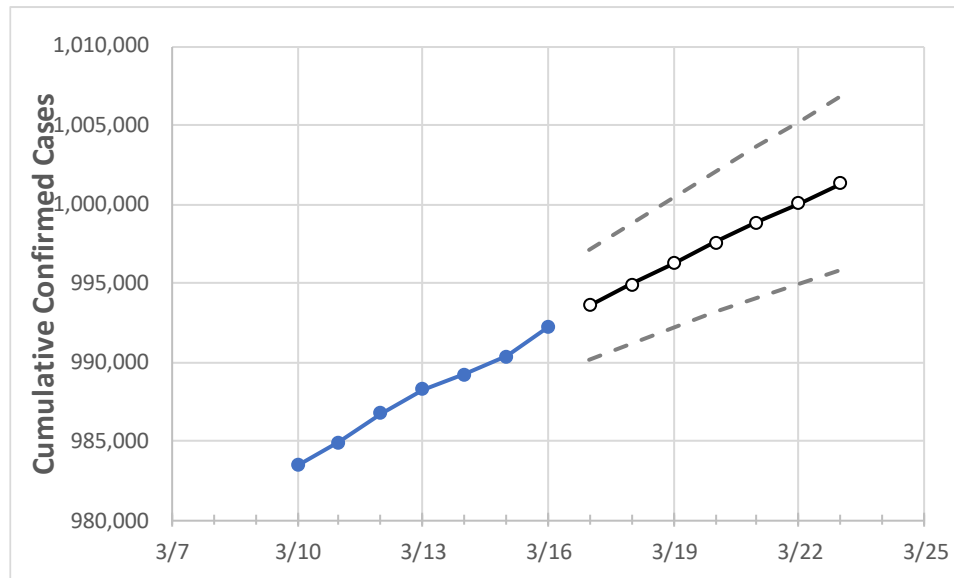
IEM's Modeling Lead

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Ohio	988,298	989,191	990,340	992,223	993,588	994,925	996,262	997,546	998,813	1,000,058	1,001,295

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Athens	4,701	4,710	4,711	4,721	4,725	4,729	4,733	4,737	4,741	4,744	4,747
Cuyahoga	98,207	98,295	98,473	98,710	98,895	99,084	99,265	99,452	99,634	99,823	100,009
Franklin	114,206	114,335	114,458	114,675	114,838	114,998	115,161	115,320	115,479	115,630	115,785
Hamilton	74,571	74,636	74,704	74,809	74,891	74,968	75,042	75,116	75,188	75,259	75,328
Lake	18,763	18,789	18,809	18,831	18,856	18,881	18,906	18,929	18,953	18,976	18,998
Lorain	22,463	22,477	22,504	22,535	22,564	22,593	22,621	22,649	22,675	22,701	22,726
Lucas	36,319	36,357	36,422	36,507	36,583	36,660	36,735	36,809	36,882	36,954	37,024
Mahoning	19,726	19,751	19,777	19,798	19,816	19,834	19,851	19,868	19,884	19,899	19,915
Medina	13,783	13,799	13,818	13,882	13,916	13,951	13,986	14,020	14,055	14,089	14,125
Miami	10,112	10,116	10,130	10,151	10,160	10,169	10,177	10,186	10,194	10,203	10,211
Summit	41,315	41,378	41,459	41,584	41,672	41,758	41,845	41,930	42,017	42,102	42,185

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:											
	3/13	3/14	3/15	3/16	3/18				3/20				3/22			
Athens	4,701	4,710	4,711	4,721	4,729	(946)	[227]	{114}	4,737	(947)	[227]	{114}	4,744	(949)	[228]	{114}
Cuyahoga	98,207	98,295	98,473	98,710	99,084	(19,817)	[4,756]	{2,378}	99,452	(19,890)	[4,774]	{2,387}	99,823	(19,965)	[4,791]	{2,396}
Franklin	114,206	114,335	114,458	114,675	114,998	(23,000)	[5,520]	{2,760}	115,320	(23,064)	[5,535]	{2,768}	115,630	(23,126)	[5,550]	{2,775}
Hamilton	74,571	74,636	74,704	74,809	74,968	(14,994)	[3,598]	{1,799}	75,116	(15,023)	[3,606]	{1,803}	75,259	(15,052)	[3,612]	{1,806}
Lake	18,763	18,789	18,809	18,831	18,881	(3,776)	[906]	{453}	18,929	(3,786)	[909]	{454}	18,976	(3,795)	[911]	{455}
Lorain	22,463	22,477	22,504	22,535	22,593	(4,519)	[1,084]	{542}	22,649	(4,530)	[1,087]	{544}	22,701	(4,540)	[1,090]	{545}
Lucas	36,319	36,357	36,422	36,507	36,660	(7,332)	[1,760]	{880}	36,809	(7,362)	[1,767]	{883}	36,954	(7,391)	[1,774]	{887}
Mahoning	19,726	19,751	19,777	19,798	19,834	(3,967)	[952]	{476}	19,868	(3,974)	[954]	{477}	19,899	(3,980)	[955]	{478}
Medina	13,783	13,799	13,818	13,882	13,951	(2,790)	[670]	{335}	14,020	(2,804)	[673]	{336}	14,089	(2,818)	[676]	{338}
Miami	10,112	10,116	10,130	10,151	10,169	(2,034)	[488]	{244}	10,186	(2,037)	[489]	{244}	10,203	(2,041)	[490]	{245}
Summit	41,315	41,378	41,459	41,584	41,758	(8,352)	[2,004]	{1,002}	41,930	(8,386)	[2,013]	{1,006}	42,102	(8,420)	[2,021]	{1,010}

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.