

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

Date: 2/23/22

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 2/23/22 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.

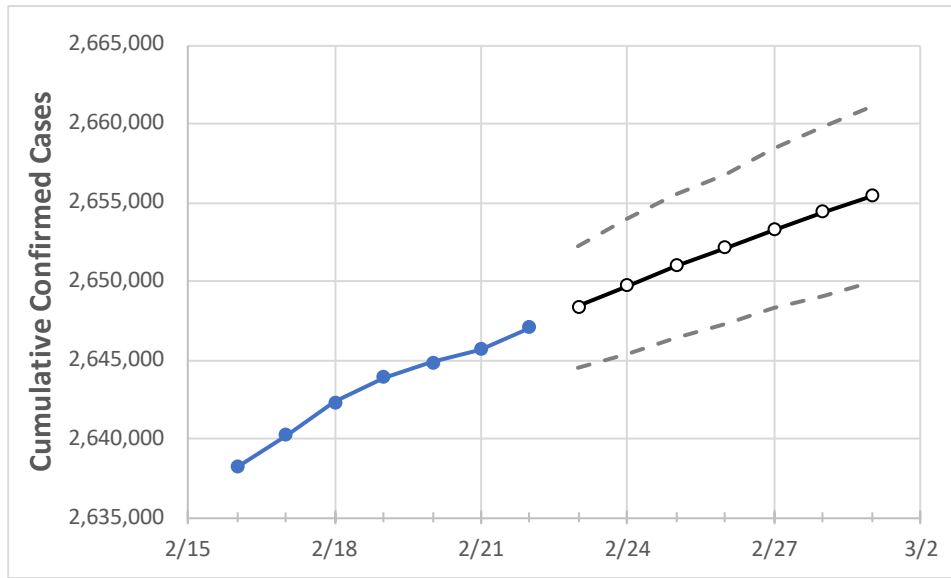
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Ohio	2,643,929	2,644,828	2,645,679	2,647,048	2,648,418	2,649,716	2,650,973	2,652,125	2,653,301	2,654,391	2,655,437

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Athens	14,177	14,188	14,194	14,205	14,227	14,252	14,272	14,296	14,318	14,338	14,357
Cuyahoga	265,766	265,830	265,865	265,948	266,036	266,116	266,195	266,273	266,349	266,421	266,491
Franklin	285,160	285,265	285,377	285,519	285,661	285,793	285,927	286,044	286,160	286,272	286,373
Hamilton	185,169	185,240	185,294	185,367	185,455	185,534	185,612	185,684	185,748	185,817	185,877
Lake	48,454	48,459	48,466	48,479	48,494	48,507	48,520	48,533	48,545	48,558	48,569
Lorain	65,952	65,967	65,984	66,017	66,056	66,086	66,113	66,150	66,178	66,204	66,232
Lucas	98,407	98,444	98,468	98,532	98,604	98,668	98,735	98,799	98,859	98,923	98,981
Mahoning	52,923	52,940	52,955	52,981	53,004	53,025	53,045	53,064	53,082	53,100	53,116
Medina	39,664	39,673	39,683	39,694	39,704	39,715	39,724	39,733	39,743	39,751	39,759
Miami	25,542	25,551	25,556	25,570	25,581	25,590	25,599	25,607	25,615	25,623	25,630
Summit	111,356	111,378	111,397	111,433	111,468	111,499	111,527	111,556	111,585	111,610	111,635

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Athens	14,177	14,188	14,194	14,205	14,252	(2,850)	[684]	{342}	14,296	(2,859)	[686]	{343}	14,338	(2,868)	[688]	{344}
Cuyahoga	265,766	265,830	265,865	265,948	266,116	(53,223)	[12,774]	{6,387}	266,273	(53,255)	[12,781]	{6,391}	266,421	(53,284)	[12,788]	{6,394}
Franklin	285,160	285,265	285,377	285,519	285,793	(57,159)	[13,718]	{6,859}	286,044	(57,209)	[13,730]	{6,865}	286,272	(57,254)	[13,741]	{6,871}
Hamilton	185,169	185,240	185,294	185,367	185,534	(37,107)	[8,906]	{4,453}	185,684	(37,137)	[8,913]	{4,456}	185,817	(37,163)	[8,919]	{4,460}
Lake	48,454	48,459	48,466	48,479	48,507	(9,701)	[2,328]	{1,164}	48,533	(9,707)	[2,330]	{1,165}	48,558	(9,712)	[2,331]	{1,165}
Lorain	65,952	65,967	65,984	66,017	66,086	(13,217)	[3,172]	{1,586}	66,150	(13,230)	[3,175]	{1,588}	66,204	(13,241)	[3,178]	{1,589}
Lucas	98,407	98,444	98,468	98,532	98,668	(19,734)	[4,736]	{2,368}	98,799	(19,760)	[4,742]	{2,371}	98,923	(19,785)	[4,748]	{2,374}
Mahoning	52,923	52,940	52,955	52,981	53,025	(10,605)	[2,545]	{1,273}	53,064	(10,613)	[2,547]	{1,274}	53,100	(10,620)	[2,549]	{1,274}
Medina	39,664	39,673	39,683	39,694	39,715	(7,943)	[1,906]	{953}	39,733	(7,947)	[1,907]	{954}	39,751	(7,950)	[1,908]	{954}
Miami	25,542	25,551	25,556	25,570	25,590	(5,118)	[1,228]	{614}	25,607	(5,121)	[1,229]	{615}	25,623	(5,125)	[1,230]	{615}
Summit	111,356	111,378	111,397	111,433	111,499	(22,300)	[5,352]	{2,676}	111,556	(22,311)	[5,355]	{2,677}	111,610	(22,322)	[5,357]	{2,679}

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.