

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

Date: 2/5/21

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 2/5/21 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.

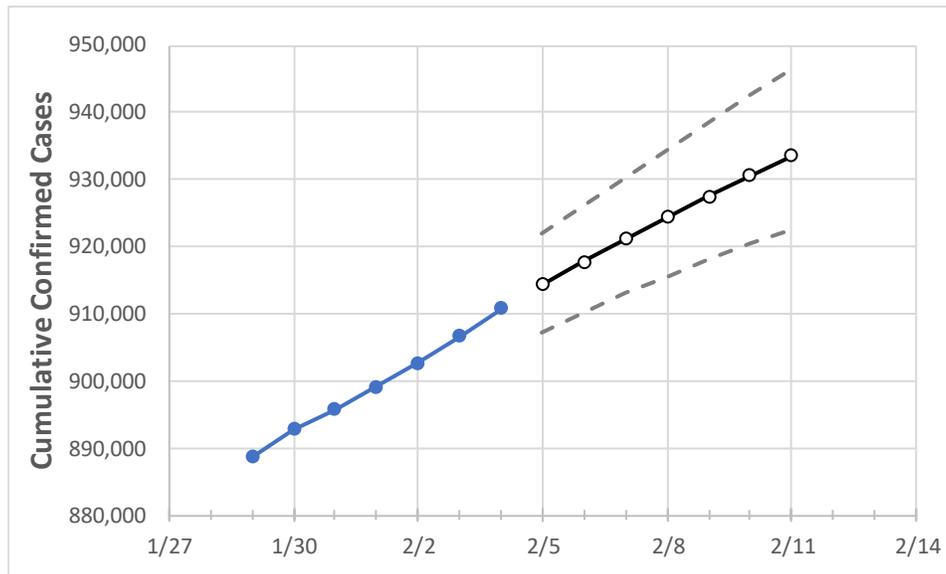
IEM's Modeling Lead

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
Ohio	899,079	902,736	906,727	910,847	914,335	917,770	921,113	924,433	927,565	930,602	933,601

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
Athens	4,060	4,089	4,127	4,169	4,199	4,230	4,261	4,291	4,321	4,352	4,383
Cuyahoga	89,371	89,554	89,881	90,243	90,557	90,858	91,160	91,447	91,729	92,000	92,249
Franklin	105,102	105,457	105,796	106,211	106,542	106,858	107,162	107,456	107,744	108,012	108,277
Hamilton	67,394	67,772	68,156	68,541	68,880	69,207	69,536	69,858	70,162	70,472	70,755
Lake	16,867	16,931	17,044	17,123	17,193	17,261	17,327	17,392	17,454	17,516	17,577
Lorain	20,107	20,199	20,311	20,412	20,509	20,603	20,695	20,788	20,875	20,960	21,043
Lucas	32,747	32,852	32,974	33,105	33,224	33,340	33,447	33,557	33,662	33,766	33,868
Mahoning	18,058	18,135	18,229	18,315	18,387	18,455	18,525	18,594	18,662	18,727	18,792
Medina	12,189	12,285	12,341	12,417	12,475	12,533	12,590	12,646	12,699	12,752	12,805
Miami	9,489	9,527	9,556	9,588	9,616	9,643	9,669	9,694	9,719	9,742	9,765
Summit	36,541	36,733	36,929	37,151	37,320	37,485	37,645	37,802	37,958	38,111	38,260

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:											
	2/1	2/2	2/3	2/4	2/6			2/8			2/10					
Athens	4,060	4,089	4,127	4,169	4,230	(846)	[203]	{102}	4,291	(858)	[206]	{103}	4,352	(870)	[209]	{104}
Cuyahoga	89,371	89,554	89,881	90,243	90,858	(18,172)	[4,361]	{2,181}	91,447	(18,289)	[4,389]	{2,195}	92,000	(18,400)	[4,416]	{2,208}
Franklin	105,102	105,457	105,796	106,211	106,858	(21,372)	[5,129]	{2,565}	107,456	(21,491)	[5,158]	{2,579}	108,012	(21,602)	[5,185]	{2,592}
Hamilton	67,394	67,772	68,156	68,541	69,207	(13,841)	[3,322]	{1,661}	69,858	(13,972)	[3,353]	{1,677}	70,472	(14,094)	[3,383]	{1,691}
Lake	16,867	16,931	17,044	17,123	17,261	(3,452)	[829]	{414}	17,392	(3,478)	[835]	{417}	17,516	(3,503)	[841]	{420}
Lorain	20,107	20,199	20,311	20,412	20,603	(4,121)	[989]	{494}	20,788	(4,158)	[998]	{499}	20,960	(4,192)	[1,006]	{503}
Lucas	32,747	32,852	32,974	33,105	33,340	(6,668)	[1,600]	{800}	33,557	(6,711)	[1,611]	{805}	33,766	(6,753)	[1,621]	{810}
Mahoning	18,058	18,135	18,229	18,315	18,455	(3,691)	[886]	{443}	18,594	(3,719)	[893]	{446}	18,727	(3,745)	[899]	{449}
Medina	12,189	12,285	12,341	12,417	12,533	(2,507)	[602]	{301}	12,646	(2,529)	[607]	{304}	12,752	(2,550)	[612]	{306}
Miami	9,489	9,527	9,556	9,588	9,643	(1,929)	[463]	{231}	9,694	(1,939)	[465]	{233}	9,742	(1,948)	[468]	{234}
Summit	36,541	36,733	36,929	37,151	37,485	(7,497)	[1,799]	{900}	37,802	(7,560)	[1,815]	{907}	38,111	(7,622)	[1,829]	{915}

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.