

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

Date: 3/5/21

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 3/5/21 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.

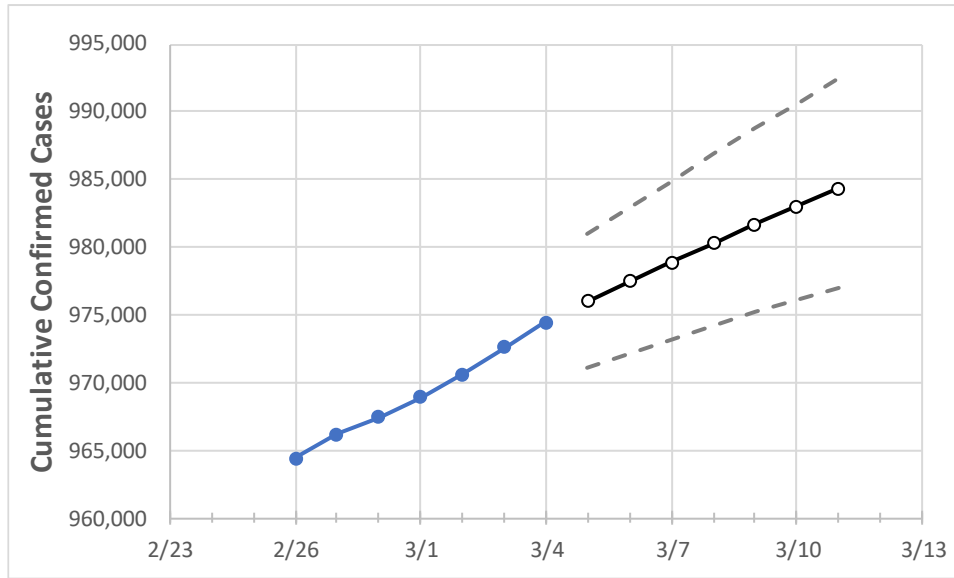
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Ohio	968,874	970,583	972,605	974,480	975,989	977,453	978,889	980,302	981,658	983,052	984,376

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Athens	4,637	4,644	4,650	4,654	4,662	4,670	4,677	4,684	4,690	4,697	4,703
Cuyahoga	95,705	95,912	96,186	96,444	96,652	96,856	97,063	97,265	97,466	97,671	97,871
Franklin	111,987	112,182	112,367	112,585	112,752	112,918	113,082	113,239	113,393	113,546	113,698
Hamilton	73,287	73,415	73,572	73,684	73,796	73,907	74,014	74,118	74,218	74,315	74,408
Lake	18,379	18,411	18,445	18,471	18,500	18,526	18,553	18,578	18,602	18,627	18,651
Lorain	21,994	22,016	22,068	22,111	22,147	22,182	22,215	22,247	22,278	22,308	22,340
Lucas	35,279	35,389	35,489	35,588	35,680	35,777	35,872	35,966	36,059	36,154	36,249
Mahoning	19,444	19,470	19,509	19,532	19,560	19,587	19,614	19,640	19,666	19,690	19,714
Medina	13,370	13,394	13,423	13,448	13,472	13,496	13,519	13,541	13,562	13,583	13,603
Miami	10,011	10,022	10,035	10,048	10,057	10,066	10,075	10,083	10,092	10,100	10,108
Summit	40,184	40,266	40,384	40,474	40,557	40,638	40,718	40,796	40,873	40,947	41,018

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:											
	3/1	3/2	3/3	3/4	3/6			3/8			3/10					
Athens	4,637	4,644	4,650	4,654	4,670	(934)	[224]	{112}	4,684	(937)	[225]	{112}	4,697	(939)	[225]	{113}
Cuyahoga	95,705	95,912	96,186	96,444	96,856	(19,371)	[4,649]	{2,325}	97,265	(19,453)	[4,669]	{2,334}	97,671	(19,534)	[4,688]	{2,344}
Franklin	111,987	112,182	112,367	112,585	112,918	(22,584)	[5,420]	{2,710}	113,239	(22,648)	[5,435]	{2,718}	113,546	(22,709)	[5,450]	{2,725}
Hamilton	73,287	73,415	73,572	73,684	73,907	(14,781)	[3,548]	{1,774}	74,118	(14,824)	[3,558]	{1,779}	74,315	(14,863)	[3,567]	{1,784}
Lake	18,379	18,411	18,445	18,471	18,526	(3,705)	[889]	{445}	18,578	(3,716)	[892]	{446}	18,627	(3,725)	[894]	{447}
Lorain	21,994	22,016	22,068	22,111	22,182	(4,436)	[1,065]	{532}	22,247	(4,449)	[1,068]	{534}	22,308	(4,462)	[1,071]	{535}
Lucas	35,279	35,389	35,489	35,588	35,777	(7,155)	[1,717]	{859}	35,966	(7,193)	[1,726]	{863}	36,154	(7,231)	[1,735]	{868}
Mahoning	19,444	19,470	19,509	19,532	19,587	(3,917)	[940]	{470}	19,640	(3,928)	[943]	{471}	19,690	(3,938)	[945]	{473}
Medina	13,370	13,394	13,423	13,448	13,496	(2,699)	[648]	{324}	13,541	(2,708)	[650]	{325}	13,583	(2,717)	[652]	{326}
Miami	10,011	10,022	10,035	10,048	10,066	(2,013)	[483]	{242}	10,083	(2,017)	[484]	{242}	10,100	(2,020)	[485]	{242}
Summit	40,184	40,266	40,384	40,474	40,638	(8,128)	[1,951]	{975}	40,796	(8,159)	[1,958]	{979}	40,947	(8,189)	[1,965]	{983}

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.