

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

Date: 3/2/21

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 3/2/21 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.

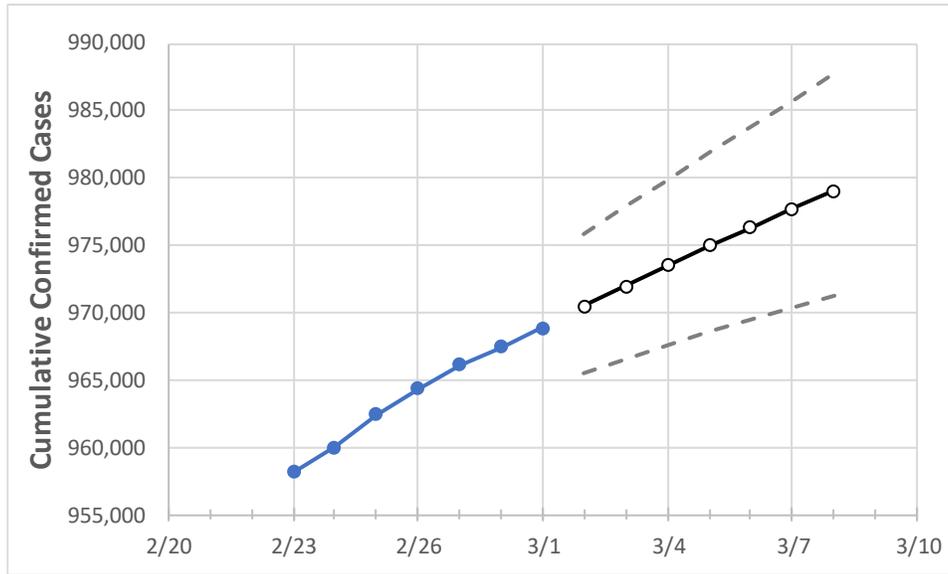
IEM's Modeling Lead

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:							
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	
Ohio	964,380	966,154	967,422	968,874	970,449	971,988	973,495	974,963	976,352	977,719	979,051	

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:							
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	
Athens	4,609	4,612	4,631	4,637	4,647	4,657	4,666	4,675	4,684	4,692	4,700	
Cuyahoga	95,078	95,332	95,484	95,705	95,888	96,068	96,242	96,415	96,583	96,754	96,923	
Franklin	111,496	111,688	111,851	111,987	112,150	112,308	112,461	112,609	112,757	112,897	113,038	
Hamilton	72,988	73,102	73,202	73,287	73,406	73,523	73,636	73,747	73,855	73,952	74,049	
Lake	18,307	18,335	18,358	18,379	18,410	18,439	18,468	18,496	18,523	18,548	18,573	
Lorain	21,904	21,938	21,952	21,994	22,032	22,069	22,104	22,139	22,172	22,204	22,236	
Lucas	35,069	35,149	35,217	35,279	35,362	35,444	35,526	35,608	35,690	35,773	35,854	
Mahoning	19,348	19,373	19,402	19,444	19,476	19,507	19,537	19,566	19,595	19,623	19,650	
Medina	13,290	13,327	13,347	13,370	13,396	13,421	13,445	13,469	13,492	13,514	13,536	
Miami	9,984	9,999	10,006	10,011	10,021	10,030	10,039	10,048	10,056	10,065	10,072	
Summit	39,949	40,041	40,110	40,184	40,270	40,354	40,433	40,511	40,585	40,658	40,728	

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:											
	2/26	2/27	2/28	3/1	3/3			3/5			3/7					
Athens	4,609	4,612	4,631	4,637	4,657	(931)	[224]	{112}	4,675	(935)	[224]	{112}	4,692	(938)	[225]	{113}
Cuyahoga	95,078	95,332	95,484	95,705	96,068	(19,214)	[4,611]	{2,306}	96,415	(19,283)	[4,628]	{2,314}	96,754	(19,351)	[4,644]	{2,322}
Franklin	111,496	111,688	111,851	111,987	112,308	(22,462)	[5,391]	{2,695}	112,609	(22,522)	[5,405]	{2,703}	112,897	(22,579)	[5,419]	{2,710}
Hamilton	72,988	73,102	73,202	73,287	73,523	(14,705)	[3,529]	{1,765}	73,747	(14,749)	[3,540]	{1,770}	73,952	(14,790)	[3,550]	{1,775}
Lake	18,307	18,335	18,358	18,379	18,439	(3,688)	[885]	{443}	18,496	(3,699)	[888]	{444}	18,548	(3,710)	[890]	{445}
Lorain	21,904	21,938	21,952	21,994	22,069	(4,414)	[1,059]	{530}	22,139	(4,428)	[1,063]	{531}	22,204	(4,441)	[1,066]	{533}
Lucas	35,069	35,149	35,217	35,279	35,444	(7,089)	[1,701]	{851}	35,608	(7,122)	[1,709]	{855}	35,773	(7,155)	[1,717]	{859}
Mahoning	19,348	19,373	19,402	19,444	19,507	(3,901)	[936]	{468}	19,566	(3,913)	[939]	{470}	19,623	(3,925)	[942]	{471}
Medina	13,290	13,327	13,347	13,370	13,421	(2,684)	[644]	{322}	13,469	(2,694)	[647]	{323}	13,514	(2,703)	[649]	{324}
Miami	9,984	9,999	10,006	10,011	10,030	(2,006)	[481]	{241}	10,048	(2,010)	[482]	{241}	10,065	(2,013)	[483]	{242}
Summit	39,949	40,041	40,110	40,184	40,354	(8,071)	[1,937]	{968}	40,511	(8,102)	[1,945]	{972}	40,658	(8,132)	[1,952]	{976}

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.