

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

Date: 3/8/21

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 3/8/21 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.

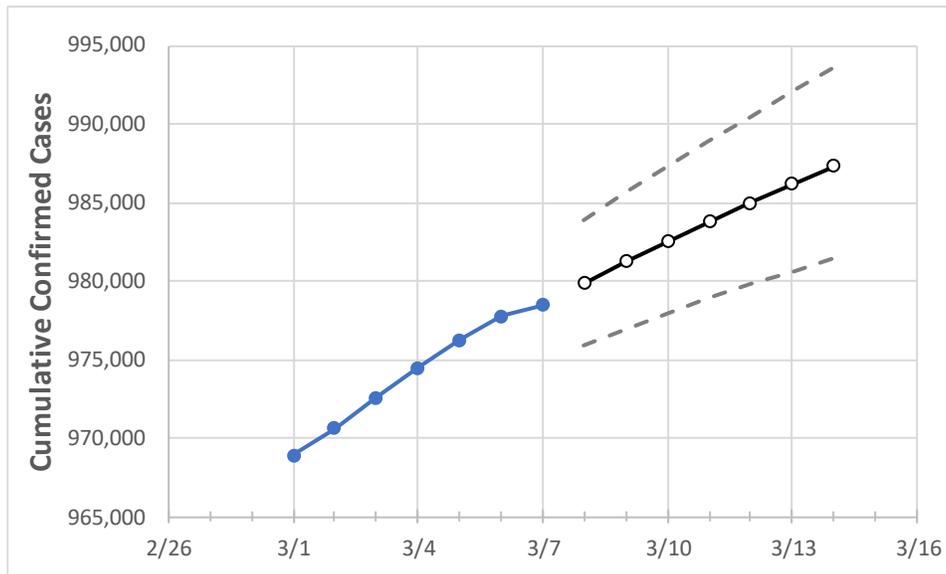
IEM's Modeling Lead

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:							
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	
Ohio	974,480	976,230	977,736	978,471	979,876	981,217	982,498	983,756	984,992	986,185	987,344	

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:							
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	
Athens	4,654	4,658	4,661	4,664	4,670	4,676	4,681	4,686	4,690	4,695	4,699	
Cuyahoga	96,444	96,670	96,856	96,933	97,130	97,324	97,515	97,702	97,896	98,088	98,274	
Franklin	112,585	112,797	112,955	113,037	113,186	113,336	113,478	113,618	113,759	113,889	114,019	
Hamilton	73,684	73,798	73,882	73,923	74,012	74,099	74,184	74,264	74,340	74,414	74,485	
Lake	18,471	18,509	18,545	18,564	18,590	18,616	18,641	18,666	18,688	18,712	18,733	
Lorain	22,111	22,149	22,190	22,218	22,250	22,281	22,311	22,341	22,370	22,397	22,425	
Lucas	35,588	35,685	35,779	35,802	35,886	35,968	36,051	36,132	36,213	36,291	36,370	
Mahoning	19,532	19,556	19,578	19,586	19,609	19,633	19,654	19,675	19,694	19,713	19,731	
Medina	13,448	13,484	13,517	13,531	13,555	13,578	13,600	13,622	13,644	13,664	13,686	
Miami	10,048	10,055	10,059	10,065	10,073	10,081	10,088	10,095	10,102	10,108	10,115	
Summit	40,474	40,562	40,668	40,720	40,798	40,873	40,947	41,020	41,093	41,163	41,232	

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:											
	3/4	3/5	3/6	3/7	3/9			3/11			3/13					
Athens	4,654	4,658	4,661	4,664	4,676	(935)	[224]	{112}	4,686	(937)	[225]	{112}	4,695	(939)	[225]	{113}
Cuyahoga	96,444	96,670	96,856	96,933	97,324	(19,465)	[4,672]	{2,336}	97,702	(19,540)	[4,690]	{2,345}	98,088	(19,618)	[4,708]	{2,354}
Franklin	112,585	112,797	112,955	113,037	113,336	(22,667)	[5,440]	{2,720}	113,618	(22,724)	[5,454]	{2,727}	113,889	(22,778)	[5,467]	{2,733}
Hamilton	73,684	73,798	73,882	73,923	74,099	(14,820)	[3,557]	{1,778}	74,264	(14,853)	[3,565]	{1,782}	74,414	(14,883)	[3,572]	{1,786}
Lake	18,471	18,509	18,545	18,564	18,616	(3,723)	[894]	{447}	18,666	(3,733)	[896]	{448}	18,712	(3,742)	[898]	{449}
Lorain	22,111	22,149	22,190	22,218	22,281	(4,456)	[1,070]	{535}	22,341	(4,468)	[1,072]	{536}	22,397	(4,479)	[1,075]	{538}
Lucas	35,588	35,685	35,779	35,802	35,968	(7,194)	[1,726]	{863}	36,132	(7,226)	[1,734]	{867}	36,291	(7,258)	[1,742]	{871}
Mahoning	19,532	19,556	19,578	19,586	19,633	(3,927)	[942]	{471}	19,675	(3,935)	[944]	{472}	19,713	(3,943)	[946]	{473}
Medina	13,448	13,484	13,517	13,531	13,578	(2,716)	[652]	{326}	13,622	(2,724)	[654]	{327}	13,664	(2,733)	[656]	{328}
Miami	10,048	10,055	10,059	10,065	10,081	(2,016)	[484]	{242}	10,095	(2,019)	[485]	{242}	10,108	(2,022)	[485]	{243}
Summit	40,474	40,562	40,668	40,720	40,873	(8,175)	[1,962]	{981}	41,020	(8,204)	[1,969]	{984}	41,163	(8,233)	[1,976]	{988}

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.