

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

Date: 1/13/21

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 1/13/21 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.

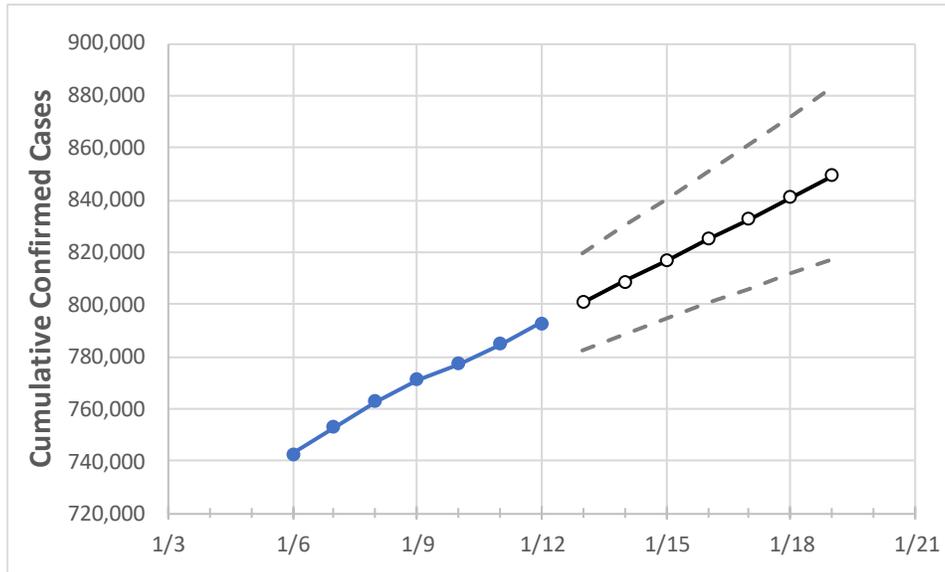
IEM's Modeling Lead

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:							
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	
Ohio	770,977	777,065	784,957	792,938	800,823	808,798	816,788	824,910	832,761	841,040	849,235	

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:							
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	
Athens	3,377	3,399	3,434	3,481	3,517	3,554	3,591	3,630	3,668	3,708	3,747	
Cuyahoga	76,667	77,359	78,231	78,970	79,723	80,474	81,236	82,000	82,766	83,540	84,309	
Franklin	91,391	92,060	93,057	93,903	94,759	95,620	96,492	97,363	98,239	99,136	100,018	
Hamilton	56,947	57,384	57,879	58,503	59,100	59,697	60,308	60,919	61,538	62,149	62,777	
Lake	14,201	14,319	14,461	14,621	14,780	14,941	15,105	15,268	15,428	15,591	15,755	
Lorain	16,612	16,771	17,071	17,196	17,398	17,602	17,804	18,005	18,208	18,411	18,617	
Lucas	28,189	28,506	28,841	29,047	29,326	29,605	29,880	30,161	30,440	30,718	30,999	
Mahoning	15,904	15,983	16,104	16,219	16,326	16,429	16,531	16,631	16,726	16,821	16,914	
Medina	10,349	10,435	10,551	10,632	10,744	10,857	10,969	11,079	11,190	11,302	11,415	
Miami	8,323	8,392	8,454	8,553	8,634	8,715	8,796	8,878	8,959	9,040	9,122	
Summit	30,858	31,089	31,539	31,877	32,207	32,530	32,860	33,190	33,517	33,843	34,169	

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:											
	1/9	1/10	1/11	1/12	1/14				1/16				1/18			
Athens	3,377	3,399	3,434	3,481	3,554 (711) [171] {85}				3,630 (726) [174] {87}				3,708 (742) [178] {89}			
Cuyahoga	76,667	77,359	78,231	78,970	80,474 (16,095) [3,863] {1,931}				82,000 (16,400) [3,936] {1,968}				83,540 (16,708) [4,010] {2,005}			
Franklin	91,391	92,060	93,057	93,903	95,620 (19,124) [4,590] {2,295}				97,363 (19,473) [4,673] {2,337}				99,136 (19,827) [4,759] {2,379}			
Hamilton	56,947	57,384	57,879	58,503	59,697 (11,939) [2,865] {1,433}				60,919 (12,184) [2,924] {1,462}				62,149 (12,430) [2,983] {1,492}			
Lake	14,201	14,319	14,461	14,621	14,941 (2,988) [717] {359}				15,268 (3,054) [733] {366}				15,591 (3,118) [748] {374}			
Lorain	16,612	16,771	17,071	17,196	17,602 (3,520) [845] {422}				18,005 (3,601) [864] {432}				18,411 (3,682) [884] {442}			
Lucas	28,189	28,506	28,841	29,047	29,605 (5,921) [1,421] {711}				30,161 (6,032) [1,448] {724}				30,718 (6,144) [1,474] {737}			
Mahoning	15,904	15,983	16,104	16,219	16,429 (3,286) [789] {394}				16,631 (3,326) [798] {399}				16,821 (3,364) [807] {404}			
Medina	10,349	10,435	10,551	10,632	10,857 (2,171) [521] {261}				11,079 (2,216) [532] {266}				11,302 (2,260) [542] {271}			
Miami	8,323	8,392	8,454	8,553	8,715 (1,743) [418] {209}				8,878 (1,776) [426] {213}				9,040 (1,808) [434] {217}			
Summit	30,858	31,089	31,539	31,877	32,530 (6,506) [1,561] {781}				33,190 (6,638) [1,593] {797}				33,843 (6,769) [1,624] {812}			

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.