

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

Date: 4/20/21

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 4/20/21 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.

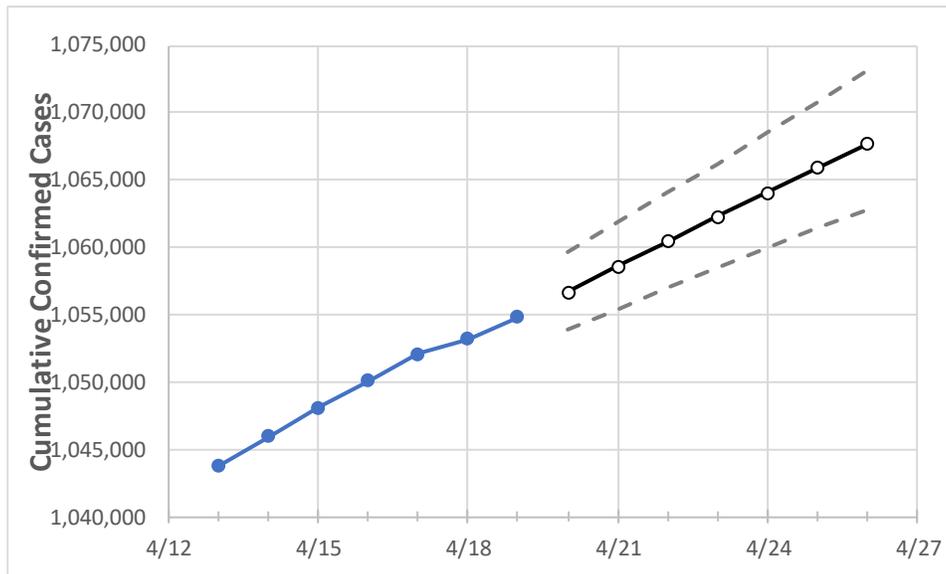
IEM's Modeling Lead

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:							
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	
Ohio	1,050,112	1,052,099	1,053,175	1,054,807	1,056,672	1,058,558	1,060,416	1,062,278	1,064,080	1,065,896	1,067,670	

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:							
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	
Athens	5,006	5,015	5,024	5,038	5,051	5,064	5,078	5,092	5,106	5,120	5,135	
Cuyahoga	106,723	107,043	107,210	107,459	107,760	108,062	108,360	108,664	108,973	109,279	109,586	
Franklin	121,928	122,167	122,299	122,519	122,759	122,997	123,235	123,468	123,709	123,947	124,177	
Hamilton	78,074	78,180	78,220	78,326	78,426	78,528	78,630	78,731	78,830	78,932	79,031	
Lake	19,963	20,009	20,038	20,067	20,110	20,153	20,196	20,238	20,281	20,324	20,367	
Lorain	24,111	24,166	24,190	24,246	24,300	24,353	24,408	24,463	24,516	24,571	24,628	
Lucas	39,984	40,122	40,200	40,298	40,433	40,569	40,705	40,845	40,982	41,120	41,258	
Mahoning	20,869	20,905	20,915	20,946	20,980	21,014	21,048	21,082	21,116	21,150	21,183	
Medina	14,839	14,868	14,898	14,922	14,950	14,978	15,005	15,033	15,060	15,087	15,114	
Miami	10,525	10,536	10,541	10,548	10,559	10,569	10,580	10,590	10,601	10,611	10,621	
Summit	45,252	45,383	45,464	45,557	45,672	45,787	45,902	46,015	46,127	46,239	46,352	

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:											
	4/16	4/17	4/18	4/19	4/21			4/23			4/25					
Athens	5,006	5,015	5,024	5,038	5,064	(1,013)	[243]	{122}	5,092	(1,018)	[244]	{122}	5,120	(1,024)	[246]	{123}
Cuyahoga	106,723	107,043	107,210	107,459	108,062	(21,612)	[5,187]	{2,593}	108,664	(21,733)	[5,216]	{2,608}	109,279	(21,856)	[5,245]	{2,623}
Franklin	121,928	122,167	122,299	122,519	122,997	(24,599)	[5,904]	{2,952}	123,468	(24,694)	[5,926]	{2,963}	123,947	(24,789)	[5,949]	{2,975}
Hamilton	78,074	78,180	78,220	78,326	78,528	(15,706)	[3,769]	{1,885}	78,731	(15,746)	[3,779]	{1,890}	78,932	(15,786)	[3,789]	{1,894}
Lake	19,963	20,009	20,038	20,067	20,153	(4,031)	[967]	{484}	20,238	(4,048)	[971]	{486}	20,324	(4,065)	[976]	{488}
Lorain	24,111	24,166	24,190	24,246	24,353	(4,871)	[1,169]	{584}	24,463	(4,893)	[1,174]	{587}	24,571	(4,914)	[1,179]	{590}
Lucas	39,984	40,122	40,200	40,298	40,569	(8,114)	[1,947]	{974}	40,845	(8,169)	[1,961]	{980}	41,120	(8,224)	[1,974]	{987}
Mahoning	20,869	20,905	20,915	20,946	21,014	(4,203)	[1,009]	{504}	21,082	(4,216)	[1,012]	{506}	21,150	(4,230)	[1,015]	{508}
Medina	14,839	14,868	14,898	14,922	14,978	(2,996)	[719]	{359}	15,033	(3,007)	[722]	{361}	15,087	(3,017)	[724]	{362}
Miami	10,525	10,536	10,541	10,548	10,569	(2,114)	[507]	{254}	10,590	(2,118)	[508]	{254}	10,611	(2,122)	[509]	{255}
Summit	45,252	45,383	45,464	45,557	45,787	(9,157)	[2,198]	{1,099}	46,015	(9,203)	[2,209]	{1,104}	46,239	(9,248)	[2,219]	{1,110}

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.