

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

Date: 12/1/20

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 12/1/20 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.

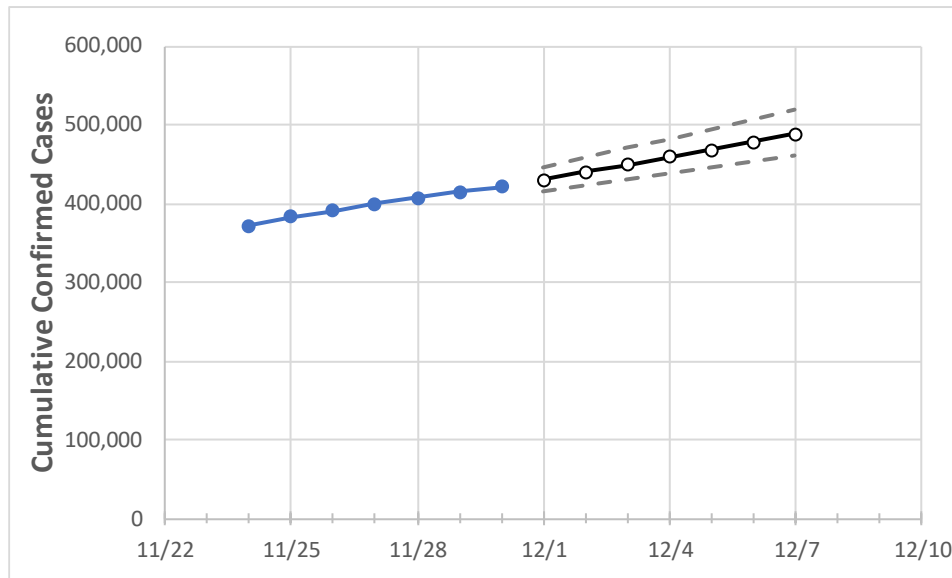
IEM's Modeling Lead

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Ohio	399,808	406,703	414,432	421,063	430,238	439,546	448,990	458,571	468,291	478,151	488,153

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 20%, and are often within 10%, of actual confirmed cases.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Athens	1,998	2,029	2,044	2,094	2,136	2,179	2,225	2,273	2,323	2,376	2,431
Cuyahoga	39,132	39,654	40,823	41,446	42,394	43,368	44,366	45,391	46,443	47,521	48,627
Franklin	52,652	53,293	53,887	54,467	55,223	55,976	56,726	57,474	58,220	58,963	59,704
Hamilton	31,491	32,049	32,557	33,221	33,795	34,374	34,958	35,548	36,143	36,744	37,351
Lake	7,525	7,706	7,890	7,994	8,199	8,404	8,608	8,813	9,018	9,223	9,428
Lorain	7,149	7,265	7,475	7,654	7,885	8,124	8,370	8,624	8,887	9,157	9,437
Lucas	15,301	15,640	15,874	16,137	16,475	16,823	17,182	17,551	17,931	18,322	18,725
Mahoning	7,985	8,123	8,282	8,405	8,628	8,857	9,092	9,334	9,581	9,835	10,095
Medina	4,965	5,064	5,180	5,266	5,404	5,546	5,691	5,840	5,993	6,150	6,310
Miami	4,562	4,655	4,756	4,851	4,968	5,089	5,212	5,338	5,467	5,600	5,736
Summit	14,667	14,905	15,205	15,417	15,791	16,173	16,565	16,967	17,378	17,799	18,231

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:											
	11/27	11/28	11/29	11/30	12/2				12/4				12/6			
Athens	1,998	2,029	2,044	2,094	2,179	(436)	[105]	{52}	2,273	(455)	[109]	{55}	2,376	(475)	[114]	{57}
Cuyahoga	39,132	39,654	40,823	41,446	43,368	(8,674)	[2,082]	{1,041}	45,391	(9,078)	[2,179]	{1,089}	47,521	(9,504)	[2,281]	{1,141}
Franklin	52,652	53,293	53,887	54,467	55,976	(11,195)	[2,687]	{1,343}	57,474	(11,495)	[2,759]	{1,379}	58,963	(11,793)	[2,830]	{1,415}
Hamilton	31,491	32,049	32,557	33,221	34,374	(6,875)	[1,650]	{825}	35,548	(7,110)	[1,706]	{853}	36,744	(7,349)	[1,764]	{882}
Lake	7,525	7,706	7,890	7,994	8,404	(1,681)	[403]	{202}	8,813	(1,763)	[423]	{212}	9,223	(1,845)	[443]	{221}
Lorain	7,149	7,265	7,475	7,654	8,124	(1,625)	[390]	{195}	8,624	(1,725)	[414]	{207}	9,157	(1,831)	[440]	{220}
Lucas	15,301	15,640	15,874	16,137	16,823	(3,365)	[808]	{404}	17,551	(3,510)	[842]	{421}	18,322	(3,664)	[879]	{440}
Mahoning	7,985	8,123	8,282	8,405	8,857	(1,771)	[425]	{213}	9,334	(1,867)	[448]	{224}	9,835	(1,967)	[472]	{236}
Medina	4,965	5,064	5,180	5,266	5,546	(1,109)	[266]	{133}	5,840	(1,168)	[280]	{140}	6,150	(1,230)	[295]	{148}
Miami	4,562	4,655	4,756	4,851	5,089	(1,018)	[244]	{122}	5,338	(1,068)	[256]	{128}	5,600	(1,120)	[269]	{134}
Summit	14,667	14,905	15,205	15,417	16,173	(3,235)	[776]	{388}	16,967	(3,393)	[814]	{407}	17,799	(3,560)	[854]	{427}

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.