

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/17/21**

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 11/17/21 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.

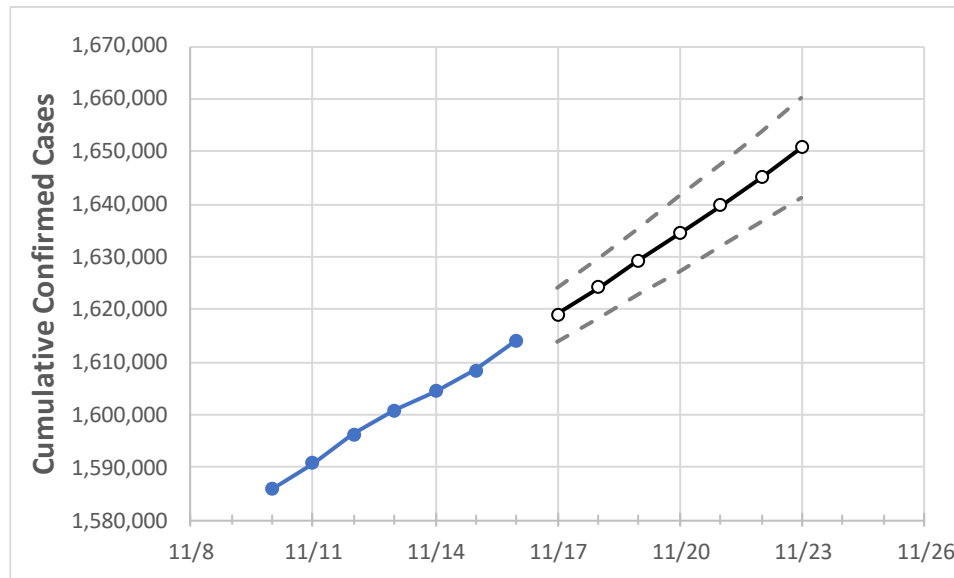
IEM's Modeling Lead

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Ohio	1,600,860	1,604,488	1,608,415	1,614,054	1,619,065	1,624,113	1,629,253	1,634,484	1,639,792	1,645,163	1,650,758

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Athens	8,061	8,073	8,083	8,090	8,102	8,113	8,123	8,135	8,148	8,158	8,169
Cuyahoga	154,623	155,077	155,557	156,064	156,635	157,223	157,824	158,440	159,076	159,728	160,390
Franklin	170,249	170,486	170,832	171,284	171,649	172,009	172,374	172,756	173,140	173,531	173,921
Hamilton	108,892	109,052	109,220	109,404	109,603	109,807	110,013	110,222	110,435	110,649	110,868
Lake	28,985	29,089	29,190	29,326	29,455	29,586	29,720	29,860	29,999	30,143	30,292
Lorain	38,215	38,320	38,467	38,608	38,779	38,949	39,122	39,302	39,486	39,676	39,863
Lucas	59,140	59,266	59,376	59,553	59,711	59,870	60,029	60,194	60,355	60,523	60,693
Mahoning	32,863	32,977	33,059	33,212	33,351	33,492	33,633	33,778	33,931	34,083	34,236
Medina	23,613	23,697	23,801	23,913	24,023	24,137	24,254	24,373	24,495	24,622	24,751
Miami	16,418	16,454	16,495	16,553	16,596	16,643	16,686	16,733	16,779	16,825	16,872
Summit	65,581	65,811	66,084	66,336	66,618	66,906	67,205	67,503	67,821	68,147	68,475

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:											
	11/13	11/14	11/15	11/16	11/18				11/20				11/22			
Athens	8,061	8,073	8,083	8,090	8,113	(1,623)	[389]	{195}	8,135	(1,627)	[390]	{195}	8,158	(1,632)	[392]	{196}
Cuyahoga	154,623	155,077	155,557	156,064	157,223	(31,445)	[7,547]	{3,773}	158,440	(31,688)	[7,605]	{3,803}	159,728	(31,946)	[7,667]	{3,833}
Franklin	170,249	170,486	170,832	171,284	172,009	(34,402)	[8,256]	{4,128}	172,756	(34,551)	[8,292]	{4,146}	173,531	(34,706)	[8,329]	{4,165}
Hamilton	108,892	109,052	109,220	109,404	109,807	(21,961)	[5,271]	{2,635}	110,222	(22,044)	[5,291]	{2,645}	110,649	(22,130)	[5,311]	{2,656}
Lake	28,985	29,089	29,190	29,326	29,586	(5,917)	[1,420]	{710}	29,860	(5,972)	[1,433]	{717}	30,143	(6,029)	[1,447]	{723}
Lorain	38,215	38,320	38,467	38,608	38,949	(7,790)	[1,870]	{935}	39,302	(7,860)	[1,887]	{943}	39,676	(7,935)	[1,904]	{952}
Lucas	59,140	59,266	59,376	59,553	59,870	(11,974)	[2,874]	{1,437}	60,194	(12,039)	[2,889]	{1,445}	60,523	(12,105)	[2,905]	{1,453}
Mahoning	32,863	32,977	33,059	33,212	33,492	(6,698)	[1,608]	{804}	33,778	(6,756)	[1,621]	{811}	34,083	(6,817)	[1,636]	{818}
Medina	23,613	23,697	23,801	23,913	24,137	(4,827)	[1,159]	{579}	24,373	(4,875)	[1,170]	{585}	24,622	(4,924)	[1,182]	{591}
Miami	16,418	16,454	16,495	16,553	16,643	(3,329)	[799]	{399}	16,733	(3,347)	[803]	{402}	16,825	(3,365)	[808]	{404}
Summit	65,581	65,811	66,084	66,336	66,906	(13,381)	[3,211]	{1,606}	67,503	(13,501)	[3,240]	{1,620}	68,147	(13,629)	[3,271]	{1,636}

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.