

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

Date: 4/13/21

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 4/13/21 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.

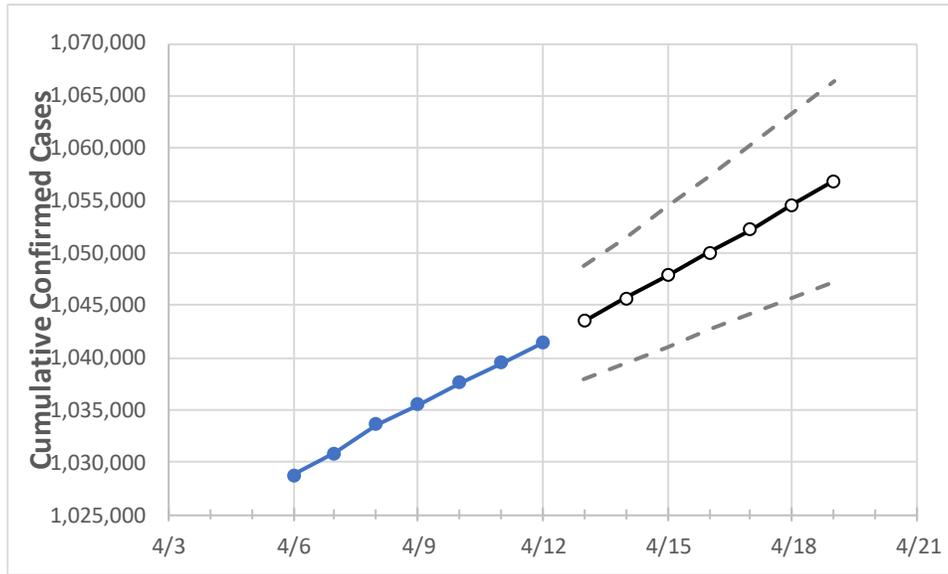
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Ohio	1,035,552	1,037,600	1,039,455	1,041,389	1,043,511	1,045,646	1,047,839	1,050,017	1,052,230	1,054,546	1,056,879

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Athens	4,917	4,936	4,948	4,958	4,971	4,984	4,997	5,011	5,025	5,040	5,054
Cuyahoga	104,537	104,849	105,180	105,470	105,795	106,129	106,468	106,813	107,169	107,533	107,902
Franklin	120,142	120,346	120,536	120,804	121,070	121,338	121,609	121,880	122,155	122,432	122,716
Hamilton	77,329	77,422	77,499	77,595	77,693	77,792	77,890	77,988	78,084	78,180	78,277
Lake	19,651	19,698	19,760	19,802	19,860	19,919	19,980	20,044	20,111	20,178	20,249
Lorain	23,710	23,775	23,831	23,887	23,948	24,009	24,071	24,135	24,199	24,263	24,332
Lucas	38,950	39,105	39,235	39,366	39,507	39,651	39,797	39,950	40,102	40,262	40,421
Mahoning	20,587	20,622	20,653	20,699	20,742	20,787	20,832	20,879	20,926	20,974	21,022
Medina	14,630	14,662	14,693	14,727	14,758	14,789	14,819	14,850	14,881	14,913	14,944
Miami	10,436	10,455	10,470	10,480	10,493	10,505	10,518	10,531	10,544	10,557	10,570
Summit	44,336	44,494	44,613	44,761	44,897	45,032	45,171	45,310	45,450	45,591	45,734

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:											
	4/9	4/10	4/11	4/12	4/14			4/16			4/18					
Athens	4,917	4,936	4,948	4,958	4,984	(997)	[239]	{120}	5,011	(1,002)	[241]	{120}	5,040	(1,008)	[242]	{121}
Cuyahoga	104,537	104,849	105,180	105,470	106,129	(21,226)	[5,094]	{2,547}	106,813	(21,363)	[5,127]	{2,564}	107,533	(21,507)	[5,162]	{2,581}
Franklin	120,142	120,346	120,536	120,804	121,338	(24,268)	[5,824]	{2,912}	121,880	(24,376)	[5,850]	{2,925}	122,432	(24,486)	[5,877]	{2,938}
Hamilton	77,329	77,422	77,499	77,595	77,792	(15,558)	[3,734]	{1,867}	77,988	(15,598)	[3,743]	{1,872}	78,180	(15,636)	[3,753]	{1,876}
Lake	19,651	19,698	19,760	19,802	19,919	(3,984)	[956]	{478}	20,044	(4,009)	[962]	{481}	20,178	(4,036)	[969]	{484}
Lorain	23,710	23,775	23,831	23,887	24,009	(4,802)	[1,152]	{576}	24,135	(4,827)	[1,158]	{579}	24,263	(4,853)	[1,165]	{582}
Lucas	38,950	39,105	39,235	39,366	39,651	(7,930)	[1,903]	{952}	39,950	(7,990)	[1,918]	{959}	40,262	(8,052)	[1,933]	{966}
Mahoning	20,587	20,622	20,653	20,699	20,787	(4,157)	[998]	{499}	20,879	(4,176)	[1,002]	{501}	20,974	(4,195)	[1,007]	{503}
Medina	14,630	14,662	14,693	14,727	14,789	(2,958)	[710]	{355}	14,850	(2,970)	[713]	{356}	14,913	(2,983)	[716]	{358}
Miami	10,436	10,455	10,470	10,480	10,505	(2,101)	[504]	{252}	10,531	(2,106)	[505]	{253}	10,557	(2,111)	[507]	{253}
Summit	44,336	44,494	44,613	44,761	45,032	(9,006)	[2,162]	{1,081}	45,310	(9,062)	[2,175]	{1,087}	45,591	(9,118)	[2,188]	{1,094}

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.