

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

Date: 4/16/21

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 4/16/21 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.

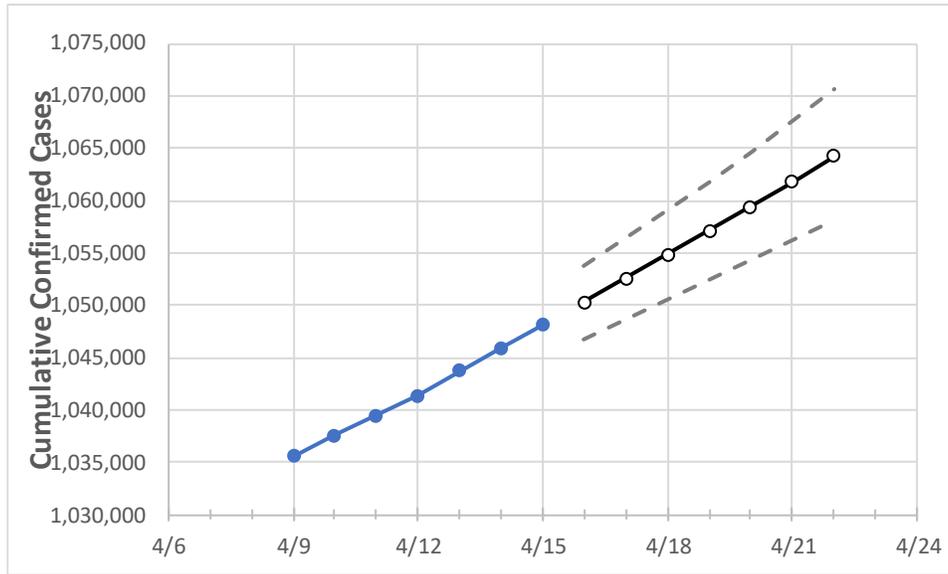
IEM's Modeling Lead

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Ohio	1,041,389	1,043,729	1,045,945	1,048,109	1,050,309	1,052,555	1,054,818	1,057,089	1,059,434	1,061,818	1,064,200

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Athens	4,958	4,966	4,974	4,994	5,007	5,021	5,035	5,050	5,065	5,080	5,095
Cuyahoga	105,470	105,771	106,088	106,398	106,728	107,062	107,403	107,753	108,111	108,468	108,845
Franklin	120,804	121,133	121,413	121,703	121,987	122,277	122,577	122,882	123,186	123,495	123,808
Hamilton	77,595	77,720	77,828	77,945	78,050	78,154	78,257	78,360	78,465	78,568	78,672
Lake	19,802	19,839	19,885	19,915	19,967	20,020	20,074	20,129	20,188	20,245	20,305
Lorain	23,887	23,968	24,038	24,090	24,157	24,223	24,291	24,360	24,432	24,504	24,579
Lucas	39,366	39,537	39,675	39,826	39,980	40,139	40,304	40,469	40,638	40,814	40,994
Mahoning	20,699	20,745	20,777	20,822	20,866	20,910	20,955	21,001	21,048	21,095	21,143
Medina	14,727	14,758	14,787	14,815	14,845	14,875	14,904	14,934	14,965	14,994	15,023
Miami	10,480	10,484	10,500	10,511	10,522	10,534	10,546	10,558	10,569	10,582	10,594
Summit	44,761	44,890	45,000	45,144	45,277	45,411	45,546	45,681	45,817	45,954	46,095

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:											
	4/12	4/13	4/14	4/15	4/17			4/19			4/21					
Athens	4,958	4,966	4,974	4,994	5,021	(1,004)	[241]	{121}	5,050	(1,010)	[242]	{121}	5,080	(1,016)	[244]	{122}
Cuyahoga	105,470	105,771	106,088	106,398	107,062	(21,412)	[5,139]	{2,569}	107,753	(21,551)	[5,172]	{2,586}	108,468	(21,694)	[5,206]	{2,603}
Franklin	120,804	121,133	121,413	121,703	122,277	(24,455)	[5,869]	{2,935}	122,882	(24,576)	[5,898]	{2,949}	123,495	(24,699)	[5,928]	{2,964}
Hamilton	77,595	77,720	77,828	77,945	78,154	(15,631)	[3,751]	{1,876}	78,360	(15,672)	[3,761]	{1,881}	78,568	(15,714)	[3,771]	{1,886}
Lake	19,802	19,839	19,885	19,915	20,020	(4,004)	[961]	{480}	20,129	(4,026)	[966]	{483}	20,245	(4,049)	[972]	{486}
Lorain	23,887	23,968	24,038	24,090	24,223	(4,845)	[1,163]	{581}	24,360	(4,872)	[1,169]	{585}	24,504	(4,901)	[1,176]	{588}
Lucas	39,366	39,537	39,675	39,826	40,139	(8,028)	[1,927]	{963}	40,469	(8,094)	[1,943]	{971}	40,814	(8,163)	[1,959]	{980}
Mahoning	20,699	20,745	20,777	20,822	20,910	(4,182)	[1,004]	{502}	21,001	(4,200)	[1,008]	{504}	21,095	(4,219)	[1,013]	{506}
Medina	14,727	14,758	14,787	14,815	14,875	(2,975)	[714]	{357}	14,934	(2,987)	[717]	{358}	14,994	(2,999)	[720]	{360}
Miami	10,480	10,484	10,500	10,511	10,534	(2,107)	[506]	{253}	10,558	(2,112)	[507]	{253}	10,582	(2,116)	[508]	{254}
Summit	44,761	44,890	45,000	45,144	45,411	(9,082)	[2,180]	{1,090}	45,681	(9,136)	[2,193]	{1,096}	45,954	(9,191)	[2,206]	{1,103}

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.