

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

Date: 5/12/21

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 5/12/21 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.

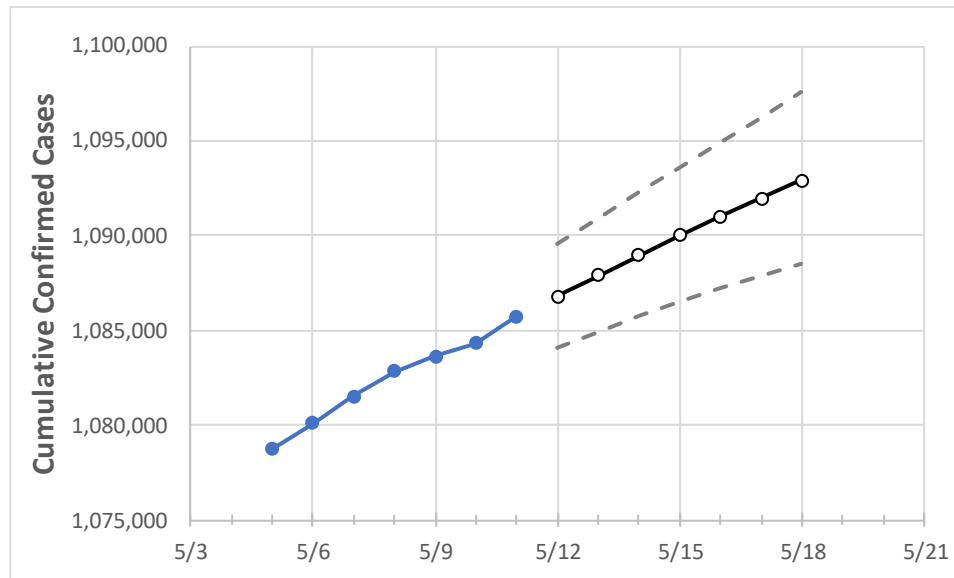
IEM's Modeling Lead

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Ohio	1,082,815	1,083,609	1,084,322	1,085,733	1,086,822	1,087,886	1,088,945	1,089,994	1,091,006	1,091,983	1,092,942

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Athens	5,191	5,193	5,194	5,200	5,203	5,205	5,208	5,210	5,212	5,214	5,216
Cuyahoga	111,972	112,117	112,224	112,407	112,578	112,744	112,902	113,058	113,213	113,362	113,505
Franklin	125,808	125,899	125,964	126,120	126,238	126,355	126,467	126,578	126,681	126,784	126,884
Hamilton	79,972	80,008	80,050	80,149	80,210	80,271	80,332	80,392	80,450	80,504	80,560
Lake	20,653	20,679	20,698	20,725	20,752	20,779	20,805	20,831	20,857	20,882	20,908
Lorain	24,997	25,015	25,026	25,046	25,075	25,103	25,131	25,158	25,184	25,210	25,235
Lucas	42,119	42,179	42,211	42,275	42,340	42,402	42,462	42,521	42,576	42,630	42,684
Mahoning	21,546	21,561	21,576	21,629	21,661	21,694	21,727	21,760	21,793	21,827	21,861
Medina	15,268	15,279	15,289	15,309	15,323	15,337	15,351	15,365	15,378	15,391	15,404
Miami	10,670	10,674	10,675	10,686	10,690	10,694	10,698	10,702	10,705	10,709	10,713
Summit	47,145	47,188	47,239	47,292	47,354	47,415	47,475	47,534	47,591	47,646	47,699

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:											
	5/8	5/9	5/10	5/11	5/13				5/15				5/17			
Athens	5,191	5,193	5,194	5,200	5,205	(1,041)	[250]	{125}	5,210	(1,042)	[250]	{125}	5,214	(1,043)	[250]	{125}
Cuyahoga	111,972	112,117	112,224	112,407	112,744	(22,549)	[5,412]	{2,706}	113,058	(22,612)	[5,427]	{2,713}	113,362	(22,672)	[5,441]	{2,721}
Franklin	125,808	125,899	125,964	126,120	126,355	(25,271)	[6,065]	{3,033}	126,578	(25,316)	[6,076]	{3,038}	126,784	(25,357)	[6,086]	{3,043}
Hamilton	79,972	80,008	80,050	80,149	80,271	(16,054)	[3,853]	{1,927}	80,392	(16,078)	[3,859]	{1,929}	80,504	(16,101)	[3,864]	{1,932}
Lake	20,653	20,679	20,698	20,725	20,779	(4,156)	[997]	{499}	20,831	(4,166)	[1,000]	{500}	20,882	(4,176)	[1,002]	{501}
Lorain	24,997	25,015	25,026	25,046	25,103	(5,021)	[1,205]	{602}	25,158	(5,032)	[1,208]	{604}	25,210	(5,042)	[1,210]	{605}
Lucas	42,119	42,179	42,211	42,275	42,402	(8,480)	[2,035]	{1,018}	42,521	(8,504)	[2,041]	{1,020}	42,630	(8,526)	[2,046]	{1,023}
Mahoning	21,546	21,561	21,576	21,629	21,694	(4,339)	[1,041]	{521}	21,760	(4,352)	[1,044]	{522}	21,827	(4,365)	[1,048]	{524}
Medina	15,268	15,279	15,289	15,309	15,337	(3,067)	[736]	{368}	15,365	(3,073)	[737]	{369}	15,391	(3,078)	[739]	{369}
Miami	10,670	10,674	10,675	10,686	10,694	(2,139)	[513]	{257}	10,702	(2,140)	[514]	{257}	10,709	(2,142)	[514]	{257}
Summit	47,145	47,188	47,239	47,292	47,415	(9,483)	[2,276]	{1,138}	47,534	(9,507)	[2,282]	{1,141}	47,646	(9,529)	[2,287]	{1,144}

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.