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

Date: 7/30/21

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 7/30/21 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.

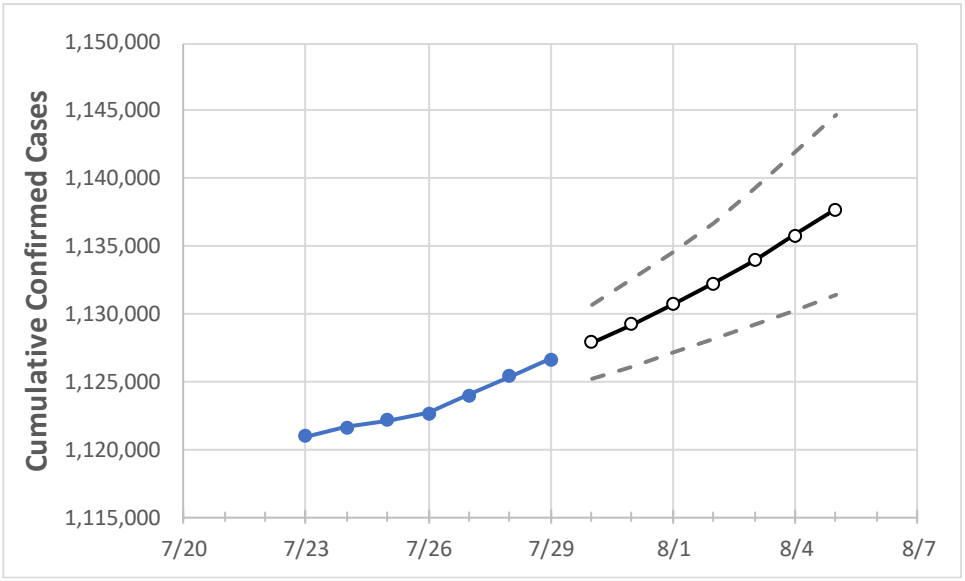
IEM's Modeling Lead

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Ohio	1,122,647	1,123,964	1,125,420	1,126,625	1,127,875	1,129,223	1,130,690	1,132,268	1,133,969	1,135,805	1,137,756

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Athens	5,265	5,269	5,272	5,276	5,278	5,280	5,282	5,284	5,287	5,289	5,292
Cuyahoga	117,150	117,254	117,395	117,484	117,587	117,698	117,813	117,938	118,069	118,211	118,362
Franklin	130,291	130,433	130,563	130,709	130,846	130,997	131,161	131,338	131,530	131,737	131,960
Hamilton	82,348	82,442	82,548	82,619	82,712	82,810	82,916	83,031	83,155	83,290	83,434
Lake	21,457	21,472	21,482	21,509	21,525	21,541	21,558	21,576	21,595	21,616	21,637
Lorain	25,996	26,029	26,072	26,104	26,146	26,193	26,243	26,300	26,364	26,432	26,510
Lucas	43,734	43,747	43,799	43,835	43,867	43,903	43,942	43,983	44,027	44,075	44,127
Mahoning	22,685	22,710	22,738	22,756	22,775	22,797	22,819	22,844	22,871	22,900	22,931
Medina	15,832	15,861	15,880	15,903	15,927	15,952	15,980	16,011	16,044	16,081	16,121
Miami	10,998	11,019	11,047	11,059	11,078	11,099	11,123	11,148	11,177	11,208	11,242
Summit	48,858	48,902	48,938	48,984	49,023	49,066	49,112	49,160	49,213	49,270	49,332

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:		
	7/26	7/27	7/28	7/29	7/31	8/2	8/4
Athens	5,265	5,269	5,272	5,276	5,280 (1,056) [253] {127}	5,284 (1,057) [254] {127}	5,289 (1,058) [254] {127}
Cuyahoga	117,150	117,254	117,395	117,484	117,698 (23,540) [5,649] {2,825}	117,938 (23,588) [5,661] {2,831}	118,211 (23,642) [5,674] {2,837}
Franklin	130,291	130,433	130,563	130,709	130,997 (26,199) [6,288] {3,144}	131,338 (26,268) [6,304] {3,152}	131,737 (26,347) [6,323] {3,162}
Hamilton	82,348	82,442	82,548	82,619	82,810 (16,562) [3,975] {1,987}	83,031 (16,606) [3,985] {1,993}	83,290 (16,658) [3,998] {1,999}
Lake	21,457	21,472	21,482	21,509	21,541 (4,308) [1,034] {517}	21,576 (4,315) [1,036] {518}	21,616 (4,323) [1,038] {519}
Lorain	25,996	26,029	26,072	26,104	26,193 (5,239) [1,257] {629}	26,300 (5,260) [1,262] {631}	26,432 (5,286) [1,269] {634}
Lucas	43,734	43,747	43,799	43,835	43,903 (8,781) [2,107] {1,054}	43,983 (8,797) [2,111] {1,056}	44,075 (8,815) [2,116] {1,058}
Mahoning	22,685	22,710	22,738	22,756	22,797 (4,559) [1,094] {547}	22,844 (4,569) [1,096] {548}	22,900 (4,580) [1,099] {550}
Medina	15,832	15,861	15,880	15,903	15,952 (3,190) [766] {383}	16,011 (3,202) [769] {384}	16,081 (3,216) [772] {386}
Miami	10,998	11,019	11,047	11,059	11,099 (2,220) [533] {266}	11,148 (2,230) [535] {268}	11,208 (2,242) [538] {269}
Summit	48,858	48,902	48,938	48,984	49,066 (9,813) [2,355] {1,178}	49,160 (9,832) [2,360] {1,180}	49,270 (9,854) [2,365] {1,182}

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.