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

Date: 5/17/21

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 5/17/21 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.

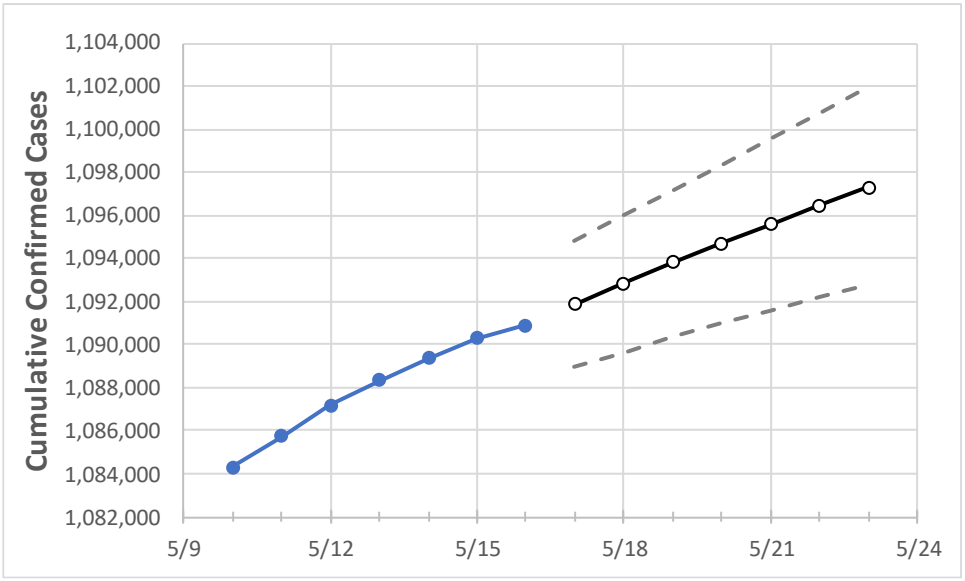
IEM's Modeling Lead

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:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
Ohio	1,088,343	1,089,357	1,090,276	1,090,894	1,091,894	1,092,846	1,093,806	1,094,695	1,095,572	1,096,451	1,097,298

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:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
Athens	5,204	5,205	5,205	5,207	5,209	5,210	5,212	5,213	5,215	5,216	5,217
Cuyahoga	112,785	112,954	113,090	113,199	113,348	113,488	113,629	113,767	113,900	114,030	114,156
Franklin	126,448	126,561	126,634	126,712	126,817	126,915	127,011	127,104	127,198	127,289	127,376
Hamilton	80,284	80,328	80,374	80,393	80,442	80,491	80,537	80,584	80,629	80,672	80,714
Lake	20,765	20,791	20,813	20,830	20,852	20,874	20,895	20,917	20,937	20,957	20,977
Lorain	25,113	25,135	25,171	25,187	25,212	25,237	25,261	25,285	25,308	25,332	25,354
Lucas	42,415	42,491	42,553	42,580	42,634	42,687	42,737	42,786	42,832	42,877	42,924
Mahoning	21,701	21,735	21,756	21,768	21,798	21,827	21,856	21,886	21,915	21,944	21,973
Medina	15,334	15,341	15,362	15,370	15,382	15,394	15,406	15,417	15,428	15,439	15,450
Miami	10,701	10,706	10,707	10,708	10,712	10,715	10,719	10,723	10,726	10,729	10,733
Summit	47,425	47,483	47,522	47,556	47,605	47,652	47,699	47,745	47,789	47,830	47,873

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:		
	5/13	5/14	5/15	5/16	5/18	5/20	5/22
Athens	5,204	5,205	5,205	5,207	5,210 (1,042) [250] {125}	5,213 (1,043) [250] {125}	5,216 (1,043) [250] {125}
Cuyahoga	112,785	112,954	113,090	113,199	113,488 (22,698) [5,447] {2,724}	113,767 (22,753) [5,461] {2,730}	114,030 (22,806) [5,473] {2,737}
Franklin	126,448	126,561	126,634	126,712	126,915 (25,383) [6,092] {3,046}	127,104 (25,421) [6,101] {3,051}	127,289 (25,458) [6,110] {3,055}
Hamilton	80,284	80,328	80,374	80,393	80,491 (16,098) [3,864] {1,932}	80,584 (16,117) [3,868] {1,934}	80,672 (16,134) [3,872] {1,936}
Lake	20,765	20,791	20,813	20,830	20,874 (4,175) [1,002] {501}	20,917 (4,183) [1,004] {502}	20,957 (4,191) [1,006] {503}
Lorain	25,113	25,135	25,171	25,187	25,237 (5,047) [1,211] {606}	25,285 (5,057) [1,214] {607}	25,332 (5,066) [1,216] {608}
Lucas	42,415	42,491	42,553	42,580	42,687 (8,537) [2,049] {1,024}	42,786 (8,557) [2,054] {1,027}	42,877 (8,575) [2,058] {1,029}
Mahoning	21,701	21,735	21,756	21,768	21,827 (4,365) [1,048] {524}	21,886 (4,377) [1,051] {525}	21,944 (4,389) [1,053] {527}
Medina	15,334	15,341	15,362	15,370	15,394 (3,079) [739] {369}	15,417 (3,083) [740] {370}	15,439 (3,088) [741] {371}
Miami	10,701	10,706	10,707	10,708	10,715 (2,143) [514] {257}	10,723 (2,145) [515] {257}	10,729 (2,146) [515] {258}
Summit	47,425	47,483	47,522	47,556	47,652 (9,530) [2,287] {1,144}	47,745 (9,549) [2,292] {1,146}	47,830 (9,566) [2,296] {1,148}

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.