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

Date: 6/2/21

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 6/2/21 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.

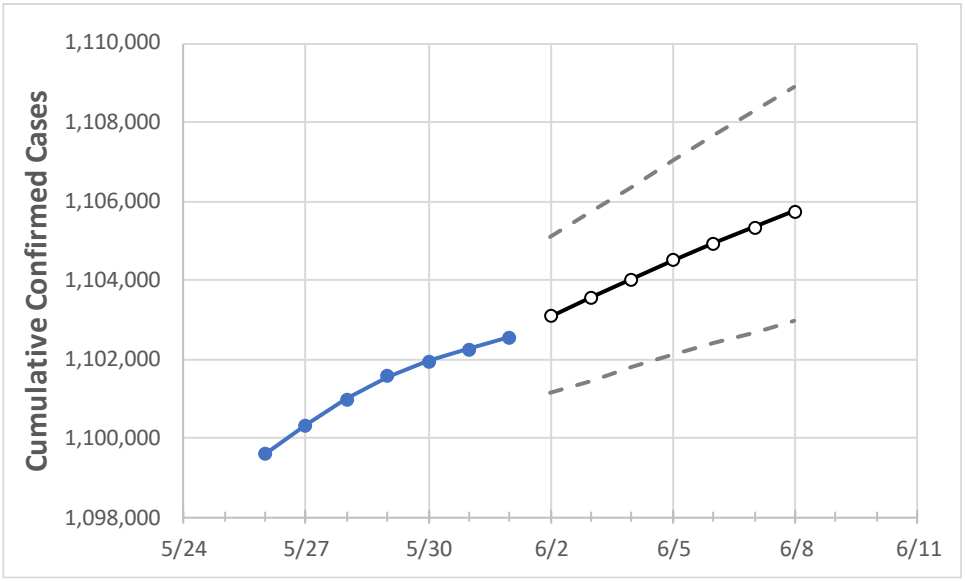
IEM's Modeling Lead

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:						
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8
Ohio	1,101,557	1,101,934	1,102,245	1,102,556	1,103,069	1,103,557	1,104,028	1,104,488	1,104,928	1,105,335	1,105,743

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:						
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8
Athens	5,219	5,220	5,221	5,221	5,222	5,222	5,223	5,224	5,225	5,225	5,226
Cuyahoga	114,852	114,914	114,962	115,009	115,088	115,163	115,234	115,303	115,369	115,432	115,493
Franklin	127,818	127,869	127,903	127,936	127,987	128,035	128,085	128,131	128,176	128,218	128,257
Hamilton	80,915	80,930	80,943	80,955	80,978	81,000	81,022	81,042	81,062	81,081	81,099
Lake	21,051	21,061	21,067	21,072	21,083	21,093	21,103	21,113	21,122	21,131	21,140
Lorain	25,495	25,504	25,507	25,509	25,524	25,539	25,553	25,567	25,581	25,594	25,607
Lucas	43,085	43,098	43,109	43,120	43,141	43,161	43,179	43,197	43,214	43,231	43,246
Mahoning	22,161	22,174	22,185	22,195	22,217	22,238	22,258	22,278	22,297	22,317	22,336
Medina	15,529	15,531	15,532	15,533	15,540	15,548	15,555	15,562	15,568	15,575	15,581
Miami	10,792	10,795	10,797	10,799	10,804	10,810	10,816	10,821	10,827	10,833	10,838
Summit	48,087	48,113	48,137	48,160	48,185	48,209	48,232	48,253	48,275	48,295	48,315

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:		
	5/29	5/30	5/31	6/1	6/3	6/5	6/7
Athens	5,219	5,220	5,221	5,221	5,222 (1,044) [251] {125}	5,224 (1,045) [251] {125}	5,225 (1,045) [251] {125}
Cuyahoga	114,852	114,914	114,962	115,009	115,163 (23,033) [5,528] {2,764}	115,303 (23,061) [5,535] {2,767}	115,432 (23,086) [5,541] {2,770}
Franklin	127,818	127,869	127,903	127,936	128,035 (25,607) [6,146] {3,073}	128,131 (25,626) [6,150] {3,075}	128,218 (25,644) [6,154] {3,077}
Hamilton	80,915	80,930	80,943	80,955	81,000 (16,200) [3,888] {1,944}	81,042 (16,208) [3,890] {1,945}	81,081 (16,216) [3,892] {1,946}
Lake	21,051	21,061	21,067	21,072	21,093 (4,219) [1,012] {506}	21,113 (4,223) [1,013] {507}	21,131 (4,226) [1,014] {507}
Lorain	25,495	25,504	25,507	25,509	25,539 (5,108) [1,226] {613}	25,567 (5,113) [1,227] {614}	25,594 (5,119) [1,229] {614}
Lucas	43,085	43,098	43,109	43,120	43,161 (8,632) [2,072] {1,036}	43,197 (8,639) [2,073] {1,037}	43,231 (8,646) [2,075] {1,038}
Mahoning	22,161	22,174	22,185	22,195	22,238 (4,448) [1,067] {534}	22,278 (4,456) [1,069] {535}	22,317 (4,463) [1,071] {536}
Medina	15,529	15,531	15,532	15,533	15,548 (3,110) [746] {373}	15,562 (3,112) [747] {373}	15,575 (3,115) [748] {374}
Miami	10,792	10,795	10,797	10,799	10,810 (2,162) [519] {259}	10,821 (2,164) [519] {260}	10,833 (2,167) [520] {260}
Summit	48,087	48,113	48,137	48,160	48,209 (9,642) [2,314] {1,157}	48,253 (9,651) [2,316] {1,158}	48,295 (9,659) [2,318] {1,159}

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.