IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/7/21

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 <u>not</u> 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 6/7/21 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
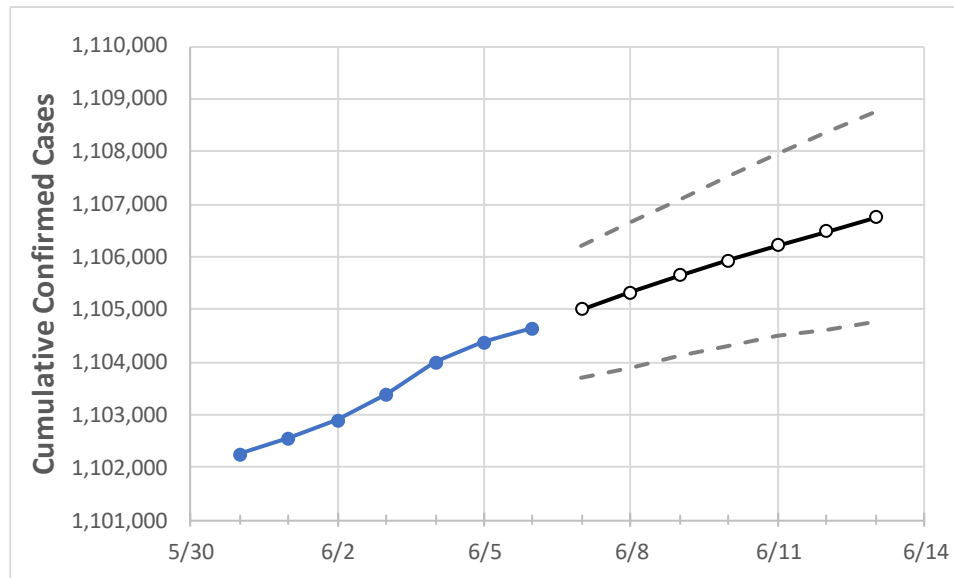
	Actual Confirmed Cases On:				Projected Cases For:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Ohio	1,103,380	1,104,001	1,104,380	1,104,648	1,104,996	1,105,321	1,105,642	1,105,929	1,106,212	1,106,482	1,106,743

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Athens	5,226	5,227	5,229	5,230	5,231	5,232	5,233	5,234	5,235	5,236	5,238
Cuyahoga	115,137	115,236	115,283	115,328	115,382	115,433	115,481	115,528	115,572	115,614	115,654
Franklin	128,033	128,116	128,156	128,192	128,235	128,276	128,315	128,352	128,387	128,422	128,456
Hamilton	81,015	81,042	81,066	81,085	81,104	81,122	81,140	81,157	81,174	81,191	81,206
Lake	21,085	21,091	21,100	21,104	21,109	21,114	21,119	21,123	21,127	21,131	21,134
Lorain	25,522	25,535	25,556	25,563	25,571	25,578	25,585	25,592	25,597	25,603	25,608
Lucas	43,149	43,166	43,178	43,187	43,199	43,210	43,220	43,229	43,238	43,247	43,254
Mahoning	22,219	22,242	22,258	22,263	22,275	22,286	22,296	22,306	22,316	22,326	22,334
Medina	15,536	15,546	15,555	15,558	15,562	15,565	15,568	15,571	15,574	15,576	15,579
Miami	10,807	10,810	10,811	10,814	10,817	10,820	10,823	10,826	10,828	10,831	10,833
Summit	48,187	48,233	48,256	48,260	48,277	48,293	48,308	48,323	48,338	48,351	48,364

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:		
	6/3	6/4	6/5	6/6	6/8	6/10	6/12
Athens	5,226	5,227	5,229	5,230	5,232 (1,046) [251] {126}	5,234 (1,047) [251] {126}	5,236 (1,047) [251] {126}
Cuyahoga	115,137	115,236	115,283	115,328	115,433 (23,087) [5,541] {2,770}	115,528 (23,106) [5,545] {2,773}	115,614 (23,123) [5,549] {2,775}
Franklin	128,033	128,116	128,156	128,192	128,276 (25,655) [6,157] {3,079}	128,352 (25,670) [6,161] {3,080}	128,422 (25,684) [6,164] {3,082}
Hamilton	81,015	81,042	81,066	81,085	81,122 (16,224) [3,894] {1,947}	81,157 (16,231) [3,896] {1,948}	81,191 (16,238) [3,897] {1,949}
Lake	21,085	21,091	21,100	21,104	21,114 (4,223) [1,013] {507}	21,123 (4,225) [1,014] {507}	21,131 (4,226) [1,014] {507}
Lorain	25,522	25,535	25,556	25,563	25,578 (5,116) [1,228] {614}	25,592 (5,118) [1,228] {614}	25,603 (5,121) [1,229] {614}
Lucas	43,149	43,166	43,178	43,187	43,210 (8,642) [2,074] {1,037}	43,229 (8,646) [2,075] {1,038}	43,247 (8,649) [2,076] {1,038}
Mahoning	22,219	22,242	22,258	22,263	22,286 (4,457) [1,070] {535}	22,306 (4,461) [1,071] {535}	22,326 (4,465) [1,072] {536}
Medina	15,536	15,546	15,555	15,558	15,565 (3,113) [747] {374}	15,571 (3,114) [747] {374}	15,576 (3,115) [748] {374}
Miami	10,807	10,810	10,811	10,814	10,820 (2,164) [519] {260}	10,826 (2,165) [520] {260}	10,831 (2,166) [520] {260}
Summit	48,187	48,233	48,256	48,260	48,293 (9,659) [2,318] {1,159}	48,323 (9,665) [2,320] {1,160}	48,351 (9,670) [2,321] {1,160}

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.