IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/24/21

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 6/24/21 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
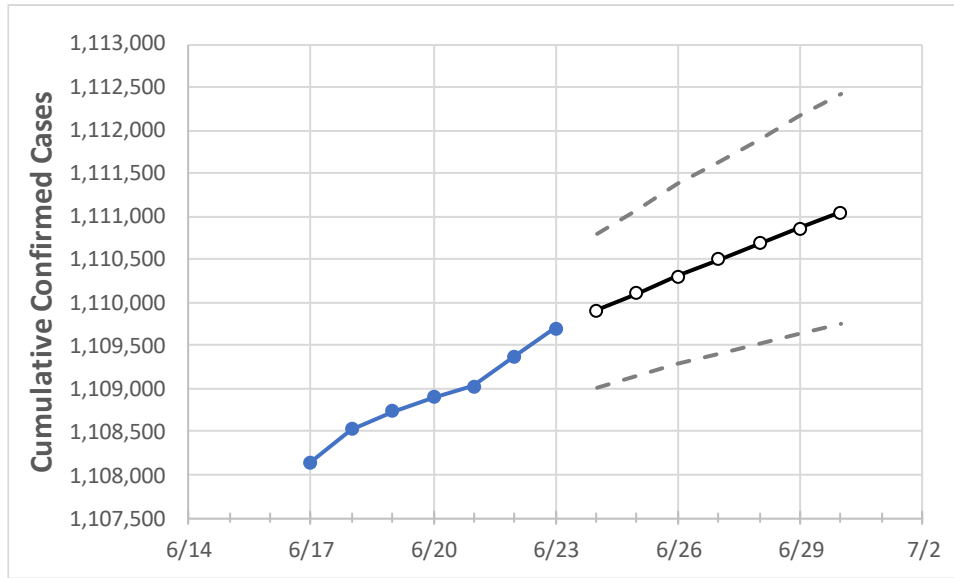
	Actual Confirmed Cases On:				Projected Cases For:						
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30
Ohio	1,108,902	1,109,025	1,109,374	1,109,697	1,109,910	1,110,111	1,110,308	1,110,500	1,110,684	1,110,865	1,111,044

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:						
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30
Athens	5,242	5,243	5,244	5,244	5,245	5,246	5,246	5,247	5,248	5,249	5,250
Cuyahoga	115,808	115,829	115,849	115,880	115,899	115,918	115,936	115,953	115,969	115,983	115,998
Franklin	128,749	128,765	128,856	128,952	128,992	129,033	129,076	129,117	129,157	129,197	129,237
Hamilton	81,409	81,413	81,416	81,420	81,434	81,447	81,460	81,473	81,485	81,496	81,507
Lake	21,211	21,213	21,216	21,219	21,224	21,230	21,236	21,241	21,247	21,252	21,257
Lorain	25,675	25,679	25,690	25,689	25,694	25,699	25,703	25,707	25,712	25,716	25,720
Lucas	43,359	43,364	43,380	43,384	43,391	43,397	43,403	43,408	43,414	43,419	43,424
Mahoning	22,376	22,378	22,383	22,388	22,392	22,396	22,399	22,403	22,406	22,409	22,412
Medina	15,612	15,613	15,615	15,618	15,620	15,622	15,623	15,625	15,627	15,628	15,630
Miami	10,850	10,850	10,857	10,857	10,859	10,861	10,864	10,866	10,868	10,870	10,872
Summit	48,435	48,440	48,443	48,455	48,463	48,471	48,479	48,486	48,493	48,500	48,507

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](link)) 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:		
	6/20	6/21	6/22	6/23	6/25	6/27	6/29
Athens	5,242	5,243	5,244	5,244	5,246 (1,049) [252] {126}	5,247 (1,049) [252] {126}	5,249 (1,050) [252] {126}
Cuyahoga	115,808	115,829	115,849	115,880	115,918 (23,184) [5,564] {2,782}	115,953 (23,191) [5,566] {2,783}	115,983 (23,197) [5,567] {2,784}
Franklin	128,749	128,765	128,856	128,952	129,033 (25,807) [6,194] {3,097}	129,117 (25,823) [6,198] {3,099}	129,197 (25,839) [6,201] {3,101}
Hamilton	81,409	81,413	81,416	81,420	81,447 (16,289) [3,909] {1,955}	81,473 (16,295) [3,911] {1,955}	81,496 (16,299) [3,912] {1,956}
Lake	21,211	21,213	21,216	21,219	21,230 (4,246) [1,019] {510}	21,241 (4,248) [1,020] {510}	21,252 (4,250) [1,020] {510}
Lorain	25,675	25,679	25,690	25,689	25,699 (5,140) [1,234] {617}	25,707 (5,141) [1,234] {617}	25,716 (5,143) [1,234] {617}
Lucas	43,359	43,364	43,380	43,384	43,397 (8,679) [2,083] {1,042}	43,408 (8,682) [2,084] {1,042}	43,419 (8,684) [2,084] {1,042}
Mahoning	22,376	22,378	22,383	22,388	22,396 (4,479) [1,075] {538}	22,403 (4,481) [1,075] {538}	22,409 (4,482) [1,076] {538}
Medina	15,612	15,613	15,615	15,618	15,622 (3,124) [750] {375}	15,625 (3,125) [750] {375}	15,628 (3,126) [750] {375}
Miami	10,850	10,850	10,857	10,857	10,861 (2,172) [521] {261}	10,866 (2,173) [522] {261}	10,870 (2,174) [522] {261}
Summit	48,435	48,440	48,443	48,455	48,471 (9,694) [2,327] {1,163}	48,486 (9,697) [2,327] {1,164}	48,500 (9,700) [2,328] {1,164}

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.