IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/14/21

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 5/14/21 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
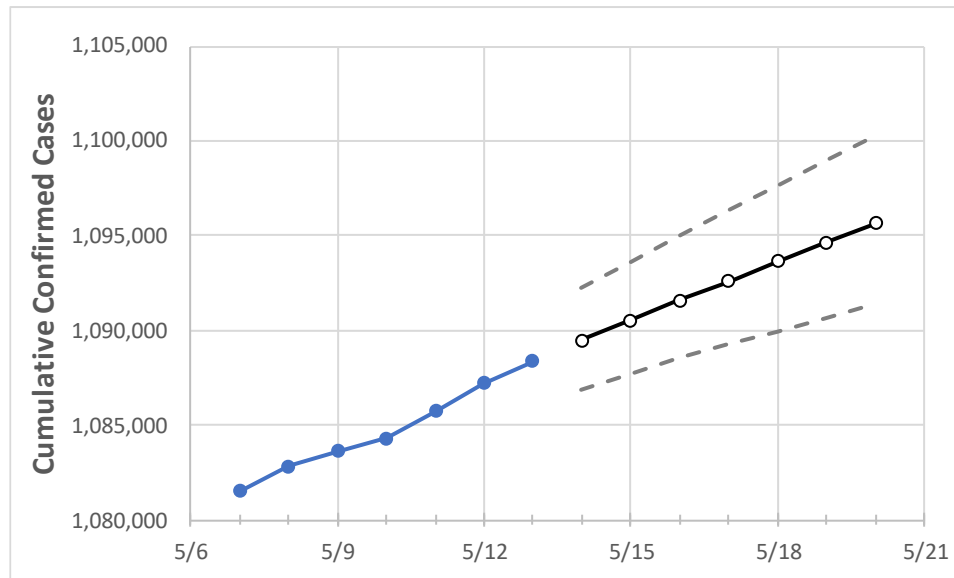
	Actual Confirmed Cases On:				Projected Cases For:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Ohio	1,084,322	1,085,733	1,087,182	1,088,343	1,089,453	1,090,523	1,091,566	1,092,606	1,093,623	1,094,635	1,095,626

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Athens	5,194	5,200	5,201	5,204	5,206	5,209	5,211	5,213	5,214	5,216	5,218
Cuyahoga	112,224	112,407	112,614	112,785	112,951	113,108	113,267	113,422	113,574	113,725	113,867
Franklin	125,964	126,120	126,289	126,448	126,569	126,689	126,806	126,922	127,032	127,143	127,252
Hamilton	80,050	80,149	80,230	80,284	80,344	80,401	80,460	80,516	80,571	80,623	80,676
Lake	20,698	20,725	20,744	20,765	20,789	20,812	20,835	20,859	20,881	20,904	20,926
Lorain	25,026	25,046	25,075	25,113	25,142	25,170	25,197	25,225	25,251	25,277	25,304
Lucas	42,211	42,275	42,358	42,415	42,477	42,534	42,590	42,646	42,702	42,754	42,805
Mahoning	21,576	21,629	21,666	21,701	21,734	21,768	21,802	21,837	21,872	21,907	21,941
Medina	15,289	15,309	15,323	15,334	15,347	15,360	15,372	15,385	15,397	15,408	15,420
Miami	10,675	10,686	10,696	10,701	10,706	10,711	10,715	10,720	10,724	10,729	10,733
Summit	47,239	47,292	47,375	47,425	47,484	47,542	47,598	47,652	47,705	47,757	47,808

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Athens	5,194	5,200	5,201	5,204	5,209 (1,042) [250] {125}	5,213 (1,043) [250] {125}	5,216 (1,043) [250] {125}
Cuyahoga	112,224	112,407	112,614	112,785	113,108 (22,622) [5,429] {2,715}	113,422 (22,684) [5,444] {2,722}	113,725 (22,745) [5,459] {2,729}
Franklin	125,964	126,120	126,289	126,448	126,689 (25,338) [6,081] {3,041}	126,922 (25,384) [6,092] {3,046}	127,143 (25,429) [6,103] {3,051}
Hamilton	80,050	80,149	80,230	80,284	80,401 (16,080) [3,859] {1,930}	80,516 (16,103) [3,865] {1,932}	80,623 (16,125) [3,870] {1,935}
Lake	20,698	20,725	20,744	20,765	20,812 (4,162) [999] {499}	20,859 (4,172) [1,001] {501}	20,904 (4,181) [1,003] {502}
Lorain	25,026	25,046	25,075	25,113	25,170 (5,034) [1,208] {604}	25,225 (5,045) [1,211] {605}	25,277 (5,055) [1,213] {607}
Lucas	42,211	42,275	42,358	42,415	42,534 (8,507) [2,042] {1,021}	42,646 (8,529) [2,047] {1,024}	42,754 (8,551) [2,052] {1,026}
Mahoning	21,576	21,629	21,666	21,701	21,768 (4,354) [1,045] {522}	21,837 (4,367) [1,048] {524}	21,907 (4,381) [1,052] {526}
Medina	15,289	15,309	15,323	15,334	15,360 (3,072) [737] {369}	15,385 (3,077) [738] {369}	15,408 (3,082) [740] {370}
Miami	10,675	10,686	10,696	10,701	10,711 (2,142) [514] {257}	10,720 (2,144) [515] {257}	10,729 (2,146) [515] {257}
Summit	47,239	47,292	47,375	47,425	47,542 (9,508) [2,282] {1,141}	47,652 (9,530) [2,287] {1,144}	47,757 (9,551) [2,292] {1,146}

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.