IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/2/21

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 <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 7/2/21 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
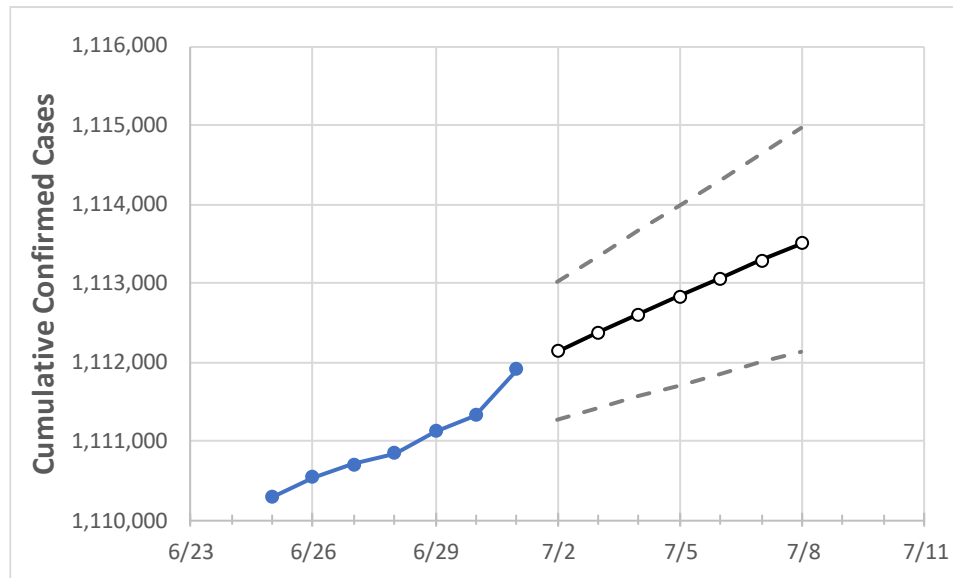
	Actual Confirmed Cases On:				Projected Cases For:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Ohio	1,110,847	1,111,124	1,111,324	1,111,903	1,112,140	1,112,376	1,112,606	1,112,832	1,113,061	1,113,281	1,113,506

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Athens	5,250	5,250	5,250	5,250	5,252	5,253	5,255	5,257	5,258	5,260	5,262
Cuyahoga	116,000	116,041	116,072	116,095	116,115	116,136	116,156	116,174	116,193	116,211	116,228
Franklin	129,120	129,164	129,181	129,199	129,233	129,267	129,301	129,334	129,368	129,399	129,431
Hamilton	81,490	81,511	81,520	81,533	81,541	81,549	81,557	81,564	81,571	81,577	81,584
Lake	21,238	21,240	21,243	21,246	21,250	21,254	21,257	21,261	21,264	21,268	21,271
Lorain	25,713	25,717	25,720	25,728	25,732	25,736	25,740	25,744	25,747	25,751	25,754
Lucas	43,422	43,437	43,446	43,451	43,457	43,462	43,467	43,473	43,478	43,483	43,488
Mahoning	22,410	22,414	22,415	22,421	22,424	22,427	22,430	22,433	22,436	22,438	22,441
Medina	15,632	15,637	15,640	15,647	15,650	15,652	15,655	15,657	15,660	15,663	15,665
Miami	10,868	10,870	10,869	10,873	10,875	10,877	10,879	10,881	10,883	10,885	10,887
Summit	48,497	48,503	48,510	48,520	48,527	48,534	48,540	48,546	48,552	48,558	48,563

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:		
	6/28	6/29	6/30	7/1	7/3	7/5	7/7
Athens	5,250	5,250	5,250	5,250	5,253 (1,051) [252] {126}	5,257 (1,051) [252] {126}	5,260 (1,052) [252] {126}
Cuyahoga	116,000	116,041	116,072	116,095	116,136 (23,227) [5,575] {2,787}	116,174 (23,235) [5,576] {2,788}	116,211 (23,242) [5,578] {2,789}
Franklin	129,120	129,164	129,181	129,199	129,267 (25,853) [6,205] {3,102}	129,334 (25,867) [6,208] {3,104}	129,399 (25,880) [6,211] {3,106}
Hamilton	81,490	81,511	81,520	81,533	81,549 (16,310) [3,914] {1,957}	81,564 (16,313) [3,915] {1,958}	81,577 (16,315) [3,916] {1,958}
Lake	21,238	21,240	21,243	21,246	21,254 (4,251) [1,020] {510}	21,261 (4,252) [1,021] {510}	21,268 (4,254) [1,021] {510}
Lorain	25,713	25,717	25,720	25,728	25,736 (5,147) [1,235] {618}	25,744 (5,149) [1,236] {618}	25,751 (5,150) [1,236] {618}
Lucas	43,422	43,437	43,446	43,451	43,462 (8,692) [2,086] {1,043}	43,473 (8,695) [2,087] {1,043}	43,483 (8,697) [2,087] {1,044}
Mahoning	22,410	22,414	22,415	22,421	22,427 (4,485) [1,077] {538}	22,433 (4,487) [1,077] {538}	22,438 (4,488) [1,077] {539}
Medina	15,632	15,637	15,640	15,647	15,652 (3,130) [751] {376}	15,657 (3,131) [752] {376}	15,663 (3,133) [752] {376}
Miami	10,868	10,870	10,869	10,873	10,877 (2,175) [522] {261}	10,881 (2,176) [522] {261}	10,885 (2,177) [522] {261}
Summit	48,497	48,503	48,510	48,520	48,534 (9,707) [2,330] {1,165}	48,546 (9,709) [2,330] {1,165}	48,558 (9,712) [2,331] {1,165}

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.