IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/1/21

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 7/1/21 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
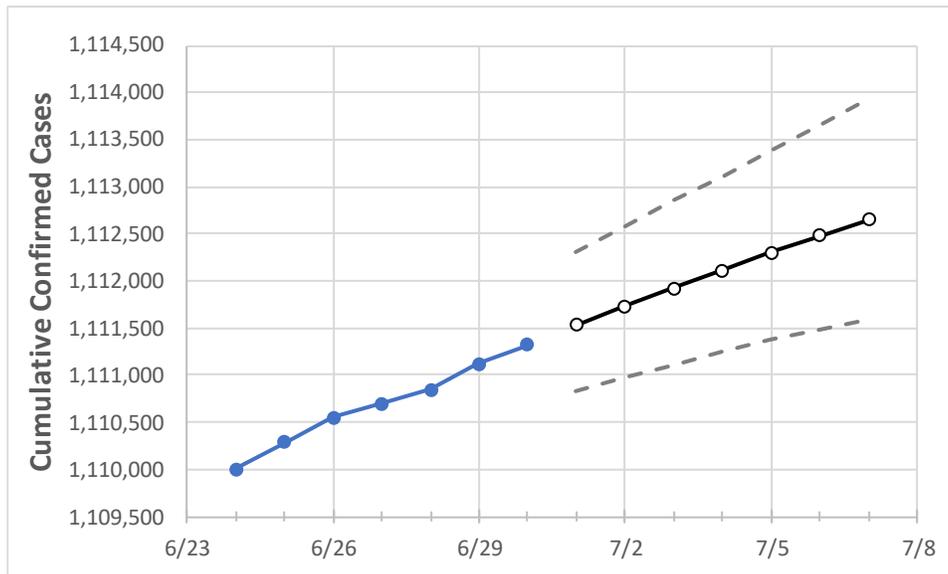
	Actual Confirmed Cases On:				Projected Cases For:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Ohio	1,110,700	1,110,847	1,111,124	1,111,324	1,111,528	1,111,729	1,111,923	1,112,117	1,112,300	1,112,478	1,112,655

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:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Athens	5,249	5,250	5,250	5,250	5,251	5,253	5,254	5,255	5,257	5,258	5,259
Cuyahoga	115,990	116,000	116,041	116,072	116,094	116,115	116,136	116,157	116,177	116,196	116,215
Franklin	129,083	129,120	129,164	129,181	129,214	129,246	129,279	129,311	129,343	129,372	129,406
Hamilton	81,484	81,490	81,511	81,520	81,528	81,536	81,544	81,551	81,557	81,564	81,571
Lake	21,237	21,238	21,240	21,240	21,245	21,250	21,255	21,260	21,264	21,269	21,273
Lorain	25,707	25,713	25,717	25,720	25,724	25,727	25,730	25,733	25,737	25,739	25,742
Lucas	43,415	43,422	43,437	43,446	43,452	43,457	43,463	43,468	43,473	43,478	43,483
Mahoning	22,409	22,410	22,414	22,415	22,418	22,421	22,424	22,427	22,430	22,433	22,435
Medina	15,631	15,632	15,637	15,640	15,642	15,644	15,646	15,648	15,650	15,652	15,654
Miami	10,867	10,868	10,870	10,869	10,871	10,872	10,874	10,876	10,877	10,879	10,880
Summit	48,491	48,497	48,503	48,510	48,517	48,523	48,529	48,535	48,540	48,546	48,551

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: | | |
	6/27	6/28	6/29	6/30	7/2	7/4	7/6
Athens	5,249	5,250	5,250	5,250	5,253 (1,051) [252] {126}	5,255 (1,051) [252] {126}	5,258 (1,052) [252] {126}
Cuyahoga	115,990	116,000	116,041	116,072	116,115 (23,223) [5,574] {2,787}	116,157 (23,231) [5,576] {2,788}	116,196 (23,239) [5,577] {2,789}
Franklin	129,083	129,120	129,164	129,181	129,246 (25,849) [6,204] {3,102}	129,311 (25,862) [6,207] {3,103}	129,372 (25,874) [6,210] {3,105}
Hamilton	81,484	81,490	81,511	81,520	81,536 (16,307) [3,914] {1,957}	81,551 (16,310) [3,914] {1,957}	81,564 (16,313) [3,915] {1,958}
Lake	21,237	21,238	21,240	21,240	21,250 (4,250) [1,020] {510}	21,260 (4,252) [1,020] {510}	21,269 (4,254) [1,021] {510}
Lorain	25,707	25,713	25,717	25,720	25,727 (5,145) [1,235] {617}	25,733 (5,147) [1,235] {618}	25,739 (5,148) [1,235] {618}
Lucas	43,415	43,422	43,437	43,446	43,457 (8,691) [2,086] {1,043}	43,468 (8,694) [2,086] {1,043}	43,478 (8,696) [2,087] {1,043}
Mahoning	22,409	22,410	22,414	22,415	22,421 (4,484) [1,076] {538}	22,427 (4,485) [1,077] {538}	22,433 (4,487) [1,077] {538}
Medina	15,631	15,632	15,637	15,640	15,644 (3,129) [751] {375}	15,648 (3,130) [751] {376}	15,652 (3,130) [751] {376}
Miami	10,867	10,868	10,870	10,869	10,872 (2,174) [522] {261}	10,876 (2,175) [522] {261}	10,879 (2,176) [522] {261}
Summit	48,491	48,497	48,503	48,510	48,523 (9,705) [2,329] {1,165}	48,535 (9,707) [2,330] {1,165}	48,546 (9,709) [2,330] {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.