IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/28/21

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 7/28/21 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
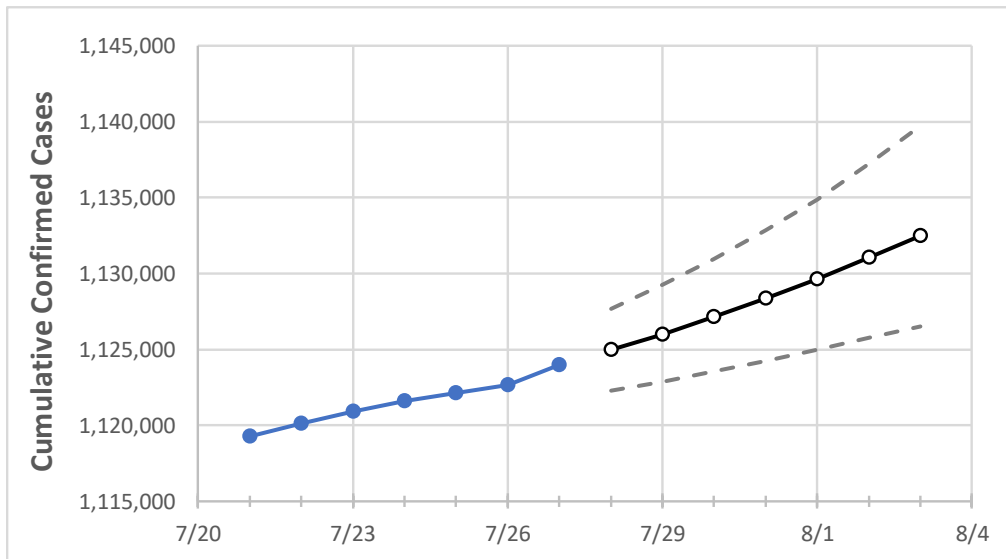
	Actual Confirmed Cases On:				Projected Cases For:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Ohio	1,121,609	1,122,104	1,122,647	1,123,964	1,124,968	1,126,004	1,127,154	1,128,358	1,129,648	1,131,049	1,132,507

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Athens	5,263	5,264	5,265	5,269	5,270	5,272	5,273	5,274	5,276	5,277	5,279
Cuyahoga	117,064	117,105	117,150	117,254	117,340	117,431	117,527	117,629	117,736	117,853	117,975
Franklin	130,169	130,214	130,291	130,433	130,540	130,656	130,781	130,915	131,059	131,215	131,379
Hamilton	82,261	82,302	82,348	82,442	82,517	82,599	82,688	82,783	82,890	82,999	83,112
Lake	21,442	21,448	21,457	21,472	21,485	21,499	21,513	21,527	21,542	21,557	21,574
Lorain	25,956	25,975	25,996	26,029	26,063	26,099	26,139	26,184	26,233	26,286	26,346
Lucas	43,709	43,716	43,734	43,747	43,772	43,798	43,827	43,857	43,890	43,925	43,961
Mahoning	22,670	22,677	22,685	22,710	22,725	22,740	22,757	22,775	22,795	22,816	22,838
Medina	15,810	15,818	15,832	15,861	15,881	15,903	15,926	15,952	15,979	16,010	16,043
Miami	10,981	10,993	10,998	11,019	11,034	11,050	11,068	11,087	11,109	11,131	11,156
Summit	48,821	48,843	48,858	48,902	48,932	48,965	48,999	49,035	49,074	49,116	49,159

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:		
	7/24	7/25	7/26	7/27	7/29	7/31	8/2
Athens	5,263	5,264	5,265	5,269	5,272 (1,054) [253] {127}	5,274 (1,055) [253] {127}	5,277 (1,055) [253] {127}
Cuyahoga	117,064	117,105	117,150	117,254	117,431 (23,486) [5,637] {2,818}	117,629 (23,526) [5,646] {2,823}	117,853 (23,571) [5,657] {2,828}
Franklin	130,169	130,214	130,291	130,433	130,656 (26,131) [6,271] {3,136}	130,915 (26,183) [6,284] {3,142}	131,215 (26,243) [6,298] {3,149}
Hamilton	82,261	82,302	82,348	82,442	82,599 (16,520) [3,965] {1,982}	82,783 (16,557) [3,974] {1,987}	82,999 (16,600) [3,984] {1,992}
Lake	21,442	21,448	21,457	21,472	21,499 (4,300) [1,032] {516}	21,527 (4,305) [1,033] {517}	21,557 (4,311) [1,035] {517}
Lorain	25,956	25,975	25,996	26,029	26,099 (5,220) [1,253] {626}	26,184 (5,237) [1,257] {628}	26,286 (5,257) [1,262] {631}
Lucas	43,709	43,716	43,734	43,747	43,798 (8,760) [2,102] {1,051}	43,857 (8,771) [2,105] {1,053}	43,925 (8,785) [2,108] {1,054}
Mahoning	22,670	22,677	22,685	22,710	22,740 (4,548) [1,092] {546}	22,775 (4,555) [1,093] {547}	22,816 (4,563) [1,095] {548}
Medina	15,810	15,818	15,832	15,861	15,903 (3,181) [763] {382}	15,952 (3,190) [766] {383}	16,010 (3,202) [768] {384}
Miami	10,981	10,993	10,998	11,019	11,050 (2,210) [530] {265}	11,087 (2,217) [532] {266}	11,131 (2,226) [534] {267}
Summit	48,821	48,843	48,858	48,902	48,965 (9,793) [2,350] {1,175}	49,035 (9,807) [2,354] {1,177}	49,116 (9,823) [2,358] {1,179}

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.