IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/16/22

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 not 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 2/16/22 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
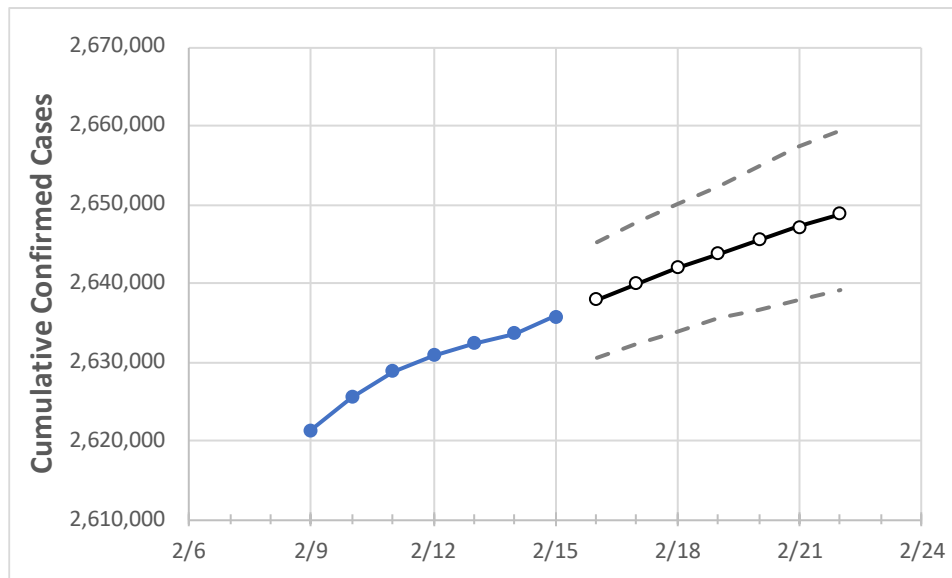
	Actual Confirmed Cases On:				Projected Cases For:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Ohio	2,630,846	2,632,336	2,633,648	2,635,769	2,637,940	2,640,014	2,641,938	2,643,708	2,645,567	2,647,217	2,648,817

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Athens	14,000	14,007	14,027	14,053	14,081	14,106	14,131	14,155	14,179	14,201	14,225
Cuyahoga	264,982	265,049	265,127	265,209	265,311	265,405	265,496	265,581	265,662	265,747	265,819
Franklin	283,736	283,922	284,109	284,294	284,506	284,721	284,910	285,106	285,291	285,458	285,613
Hamilton	184,335	184,441	184,514	184,652	184,797	184,930	185,057	185,174	185,289	185,397	185,497
Lake	48,322	48,343	48,361	48,373	48,392	48,409	48,426	48,442	48,458	48,473	48,487
Lorain	65,799	65,820	65,835	65,856	65,898	65,944	65,990	66,030	66,069	66,107	66,148
Lucas	97,667	97,725	97,751	97,914	98,001	98,086	98,164	98,247	98,316	98,390	98,453
Mahoning	52,715	52,748	52,778	52,811	52,845	52,875	52,905	52,935	52,961	52,988	53,012
Medina	39,554	39,571	39,577	39,598	39,615	39,630	39,645	39,658	39,673	39,684	39,697
Miami	25,435	25,448	25,461	25,483	25,500	25,517	25,534	25,548	25,563	25,576	25,590
Summit	111,067	111,114	111,144	111,187	111,234	111,279	111,321	111,363	111,401	111,439	111,476

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Athens	14,000	14,007	14,027	14,053	14,106 (2,821) [677] {339}	14,155 (2,831) [679] {340}	14,201 (2,840) [682] {341}
Cuyahoga	264,982	265,049	265,127	265,209	265,405 (53,081) [12,739] {6,370}	265,581 (53,116) [12,748] {6,374}	265,747 (53,149) [12,756] {6,378}
Franklin	283,736	283,922	284,109	284,294	284,721 (56,944) [13,667] {6,833}	285,106 (57,021) [13,685] {6,843}	285,458 (57,092) [13,702] {6,851}
Hamilton	184,335	184,441	184,514	184,652	184,930 (36,986) [8,877] {4,438}	185,174 (37,035) [8,888] {4,444}	185,397 (37,079) [8,899] {4,450}
Lake	48,322	48,343	48,361	48,373	48,409 (9,682) [2,324] {1,162}	48,442 (9,688) [2,325] {1,163}	48,473 (9,695) [2,327] {1,163}
Lorain	65,799	65,820	65,835	65,856	65,944 (13,189) [3,165] {1,583}	66,030 (13,206) [3,169] {1,585}	66,107 (13,221) [3,173] {1,587}
Lucas	97,667	97,725	97,751	97,914	98,086 (19,617) [4,708] {2,354}	98,247 (19,649) [4,716] {2,358}	98,390 (19,678) [4,723] {2,361}
Mahoning	52,715	52,748	52,778	52,811	52,875 (10,575) [2,538] {1,269}	52,935 (10,587) [2,541] {1,270}	52,988 (10,598) [2,543] {1,272}
Medina	39,554	39,571	39,577	39,598	39,630 (7,926) [1,902] {951}	39,658 (7,932) [1,904] {952}	39,684 (7,937) [1,905] {952}
Miami	25,435	25,448	25,461	25,483	25,517 (5,103) [1,225] {612}	25,548 (5,110) [1,226] {613}	25,576 (5,115) [1,228] {614}
Summit	111,067	111,114	111,144	111,187	111,279 (22,256) [5,341] {2,671}	111,363 (22,273) [5,345] {2,673}	111,439 (22,288) [5,349] {2,675}

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.