IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/31/22

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 <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 1/31/22 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
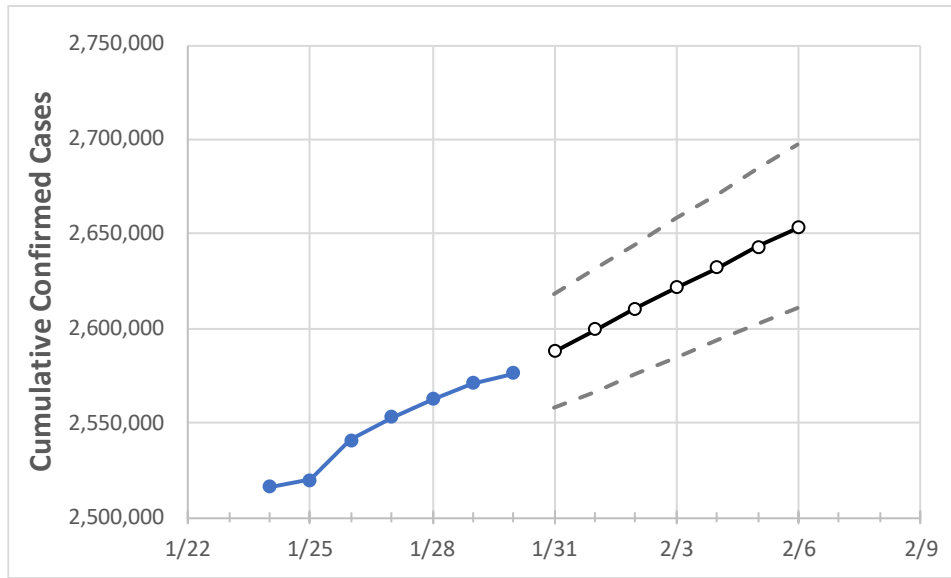
	Actual Confirmed Cases On:				Projected Cases For:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Ohio	2,552,972	2,562,412	2,571,021	2,576,245	2,588,036	2,599,460	2,610,493	2,621,893	2,632,046	2,643,113	2,653,467

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Athens	13,144	13,257	13,340	13,382	13,491	13,597	13,702	13,806	13,911	14,014	14,114
Cuyahoga	261,856	262,213	262,532	262,732	263,051	263,373	263,653	263,938	264,192	264,462	264,701
Franklin	275,624	276,631	277,516	278,141	279,357	280,616	281,748	282,951	284,014	285,170	286,257
Hamilton	178,654	179,456	180,144	180,591	181,600	182,581	183,508	184,421	185,377	186,265	187,160
Lake	47,803	47,837	47,881	47,924	47,991	48,048	48,104	48,157	48,207	48,259	48,300
Lorain	64,586	64,687	64,761	64,810	64,925	65,041	65,140	65,240	65,340	65,435	65,519
Lucas	94,853	95,192	95,466	95,675	96,156	96,592	97,044	97,452	97,869	98,281	98,659
Mahoning	51,675	51,787	51,892	51,967	52,116	52,252	52,386	52,524	52,659	52,790	52,902
Medina	38,963	39,036	39,104	39,135	39,235	39,324	39,412	39,503	39,577	39,658	39,736
Miami	24,665	24,767	24,866	24,914	25,079	25,243	25,401	25,557	25,722	25,878	26,036
Summit	109,540	109,678	109,865	109,963	110,140	110,301	110,462	110,613	110,748	110,894	111,023

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: | | |
	1/27	1/28	1/29	1/30	2/1	2/3	2/5
Athens	13,144	13,257	13,340	13,382	13,597 (2,719) [653] {326}	13,806 (2,761) [663] {331}	14,014 (2,803) [673] {336}
Cuyahoga	261,856	262,213	262,532	262,732	263,373 (52,675) [12,642] {6,321}	263,938 (52,788) [12,669] {6,335}	264,462 (52,892) [12,694] {6,347}
Franklin	275,624	276,631	277,516	278,141	280,616 (56,123) [13,470] {6,735}	282,951 (56,590) [13,582] {6,791}	285,170 (57,034) [13,688] {6,844}
Hamilton	178,654	179,456	180,144	180,591	182,581 (36,516) [8,764] {4,382}	184,421 (36,884) [8,852] {4,426}	186,265 (37,253) [8,941] {4,470}
Lake	47,803	47,837	47,881	47,924	48,048 (9,610) [2,306] {1,153}	48,157 (9,631) [2,312] {1,156}	48,259 (9,652) [2,316] {1,158}
Lorain	64,586	64,687	64,761	64,810	65,041 (13,008) [3,122] {1,561}	65,240 (13,048) [3,132] {1,566}	65,435 (13,087) [3,141] {1,570}
Lucas	94,853	95,192	95,466	95,675	96,592 (19,318) [4,636] {2,318}	97,452 (19,490) [4,678] {2,339}	98,281 (19,656) [4,717] {2,359}
Mahoning	51,675	51,787	51,892	51,967	52,252 (10,450) [2,508] {1,254}	52,524 (10,505) [2,521] {1,261}	52,790 (10,558) [2,534] {1,267}
Medina	38,963	39,036	39,104	39,135	39,324 (7,865) [1,888] {944}	39,503 (7,901) [1,896] {948}	39,658 (7,932) [1,904] {952}
Miami	24,665	24,767	24,866	24,914	25,243 (5,049) [1,212] {606}	25,557 (5,111) [1,227] {613}	25,878 (5,176) [1,242] {621}
Summit	109,540	109,678	109,865	109,963	110,301 (22,060) [5,294] {2,647}	110,613 (22,123) [5,309] {2,655}	110,894 (22,179) [5,323] {2,661}

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.