IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/14/22

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 1/14/22 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
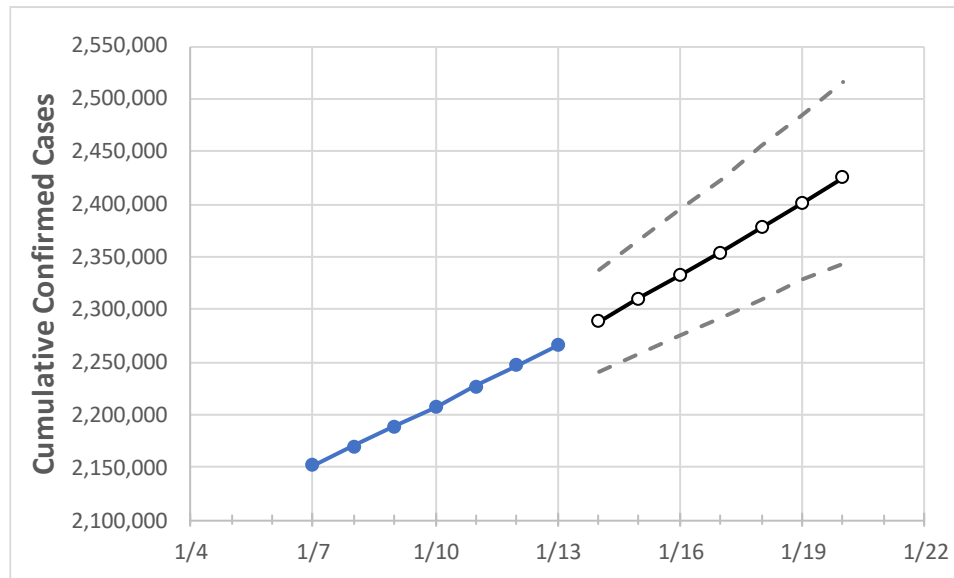
	Actual Confirmed Cases On:				Projected Cases For:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Ohio	2,207,270	2,226,881	2,246,974	2,266,236	2,288,591	2,310,608	2,332,769	2,354,606	2,377,717	2,400,980	2,424,908

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Athens	9,838	9,988	10,237	10,415	10,594	10,784	10,992	11,212	11,447	11,702	11,980
Cuyahoga	247,264	248,428	249,754	250,700	251,976	253,212	254,403	255,526	256,631	257,663	258,695
Franklin	235,422	237,774	240,031	242,206	245,079	247,976	250,908	253,972	257,035	260,245	263,542
Hamilton	148,833	151,013	152,652	154,415	156,503	158,606	160,797	163,026	165,373	167,748	170,177
Lake	44,837	45,094	45,341	45,535	45,811	46,082	46,339	46,597	46,839	47,087	47,321
Lorain	59,413	59,784	60,223	60,620	61,077	61,545	61,986	62,432	62,848	63,279	63,706
Lucas	79,644	80,938	82,228	83,088	84,164	85,266	86,384	87,541	88,730	89,979	91,264
Mahoning	45,740	46,182	46,642	46,922	47,362	47,797	48,231	48,669	49,116	49,567	50,017
Medina	35,495	35,768	36,046	36,337	36,670	37,003	37,332	37,658	37,989	38,318	38,648
Miami	20,774	20,916	21,100	21,290	21,467	21,649	21,837	22,029	22,225	22,429	22,634
Summit	101,012	101,539	102,355	103,048	103,886	104,699	105,492	106,268	107,062	107,844	108,612

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:		
	1/10	1/11	1/12	1/13	1/15	1/17	1/19
Athens	9,838	9,988	10,237	10,415	10,784 (2,157) [518] {259}	11,212 (2,242) [538] {269}	11,702 (2,340) [562] {281}
Cuyahoga	247,264	248,428	249,754	250,700	253,212 (50,642) [12,154] {6,077}	255,526 (51,105) [12,265] {6,133}	257,663 (51,533) [12,368] {6,184}
Franklin	235,422	237,774	240,031	242,206	247,976 (49,595) [11,903] {5,951}	253,972 (50,794) [12,191] {6,095}	260,245 (52,049) [12,492] {6,246}
Hamilton	148,833	151,013	152,652	154,415	158,606 (31,721) [7,613] {3,807}	163,026 (32,605) [7,825] {3,913}	167,748 (33,550) [8,052] {4,026}
Lake	44,837	45,094	45,341	45,535	46,082 (9,216) [2,212] {1,106}	46,597 (9,319) [2,237] {1,118}	47,087 (9,417) [2,260] {1,130}
Lorain	59,413	59,784	60,223	60,620	61,545 (12,309) [2,954] {1,477}	62,432 (12,486) [2,997] {1,498}	63,279 (12,656) [3,037] {1,519}
Lucas	79,644	80,938	82,228	83,088	85,266 (17,053) [4,093] {2,046}	87,541 (17,508) [4,202] {2,101}	89,979 (17,996) [4,319] {2,160}
Mahoning	45,740	46,182	46,642	46,922	47,797 (9,559) [2,294] {1,147}	48,669 (9,734) [2,336] {1,168}	49,567 (9,913) [2,379] {1,190}
Medina	35,495	35,768	36,046	36,337	37,003 (7,401) [1,776] {888}	37,658 (7,532) [1,808] {904}	38,318 (7,664) [1,839] {920}
Miami	20,774	20,916	21,100	21,290	21,649 (4,330) [1,039] {520}	22,029 (4,406) [1,057] {529}	22,429 (4,486) [1,077] {538}
Summit	101,012	101,539	102,355	103,048	104,699 (20,940) [5,026] {2,513}	106,268 (21,254) [5,101] {2,550}	107,844 (21,569) [5,177] {2,588}

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.