IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/6/21

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 10/6/21 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
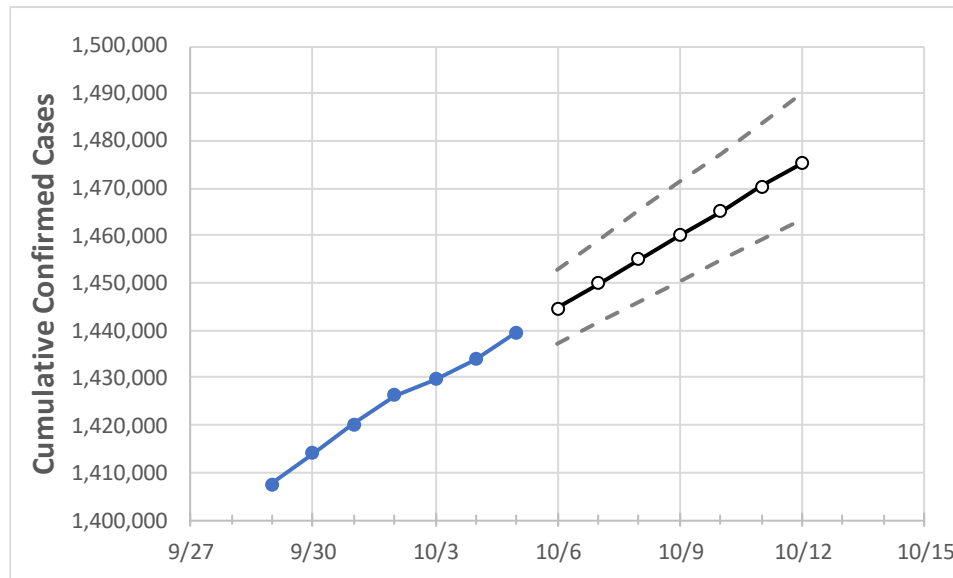
	Actual Confirmed Cases On:				Projected Cases For:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Ohio	1,426,300	1,429,745	1,433,957	1,439,490	1,444,699	1,449,851	1,455,051	1,460,098	1,465,214	1,470,345	1,475,244

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Athens	7,336	7,349	7,368	7,399	7,429	7,457	7,487	7,514	7,542	7,570	7,597
Cuyahoga	138,746	139,093	139,423	139,831	140,229	140,621	141,012	141,402	141,786	142,172	142,562
Franklin	157,071	157,296	157,634	158,084	158,490	158,894	159,272	159,678	160,057	160,446	160,822
Hamilton	100,935	101,129	101,339	101,567	101,851	102,120	102,388	102,663	102,918	103,184	103,451
Lake	25,340	25,393	25,468	25,543	25,618	25,695	25,771	25,846	25,923	26,002	26,078
Lorain	33,070	33,160	33,317	33,513	33,660	33,810	33,955	34,101	34,247	34,397	34,542
Lucas	52,980	53,092	53,223	53,355	53,534	53,710	53,887	54,063	54,236	54,411	54,586
Mahoning	28,375	28,472	28,565	28,722	28,854	28,985	29,111	29,240	29,370	29,506	29,629
Medina	20,696	20,743	20,812	20,920	21,005	21,087	21,169	21,251	21,335	21,418	21,500
Miami	14,523	14,562	14,632	14,684	14,752	14,818	14,884	14,953	15,018	15,087	15,154
Summit	58,208	58,348	58,506	58,699	58,888	59,074	59,262	59,450	59,639	59,830	60,019

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:		
	10/2	10/3	10/4	10/5	10/7	10/9	10/11
Athens	7,336	7,349	7,368	7,399	7,457 (1,491) [358] {179}	7,514 (1,503) [361] {180}	7,570 (1,514) [363] {182}
Cuyahoga	138,746	139,093	139,423	139,831	140,621 (28,124) [6,750] {3,375}	141,402 (28,280) [6,787] {3,394}	142,172 (28,434) [6,824] {3,412}
Franklin	157,071	157,296	157,634	158,084	158,894 (31,779) [7,627] {3,813}	159,678 (31,936) [7,665] {3,832}	160,446 (32,089) [7,701] {3,851}
Hamilton	100,935	101,129	101,339	101,567	102,120 (20,424) [4,902] {2,451}	102,663 (20,533) [4,928] {2,464}	103,184 (20,637) [4,953] {2,476}
Lake	25,340	25,393	25,468	25,543	25,695 (5,139) [1,233] {617}	25,846 (5,169) [1,241] {620}	26,002 (5,200) [1,248] {624}
Lorain	33,070	33,160	33,317	33,513	33,810 (6,762) [1,623] {811}	34,101 (6,820) [1,637] {818}	34,397 (6,879) [1,651] {826}
Lucas	52,980	53,092	53,223	53,355	53,710 (10,742) [2,578] {1,289}	54,063 (10,813) [2,595] {1,298}	54,411 (10,882) [2,612] {1,306}
Mahoning	28,375	28,472	28,565	28,722	28,985 (5,797) [1,391] {696}	29,240 (5,848) [1,404] {702}	29,506 (5,901) [1,416] {708}
Medina	20,696	20,743	20,812	20,920	21,087 (4,217) [1,012] {506}	21,251 (4,250) [1,020] {510}	21,418 (4,284) [1,028] {514}
Miami	14,523	14,562	14,632	14,684	14,818 (2,964) [711] {356}	14,953 (2,991) [718] {359}	15,087 (3,017) [724] {362}
Summit	58,208	58,348	58,506	58,699	59,074 (11,815) [2,836] {1,418}	59,450 (11,890) [2,854] {1,427}	59,830 (11,966) [2,872] {1,436}

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.