IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/11/21

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 1/11/21 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
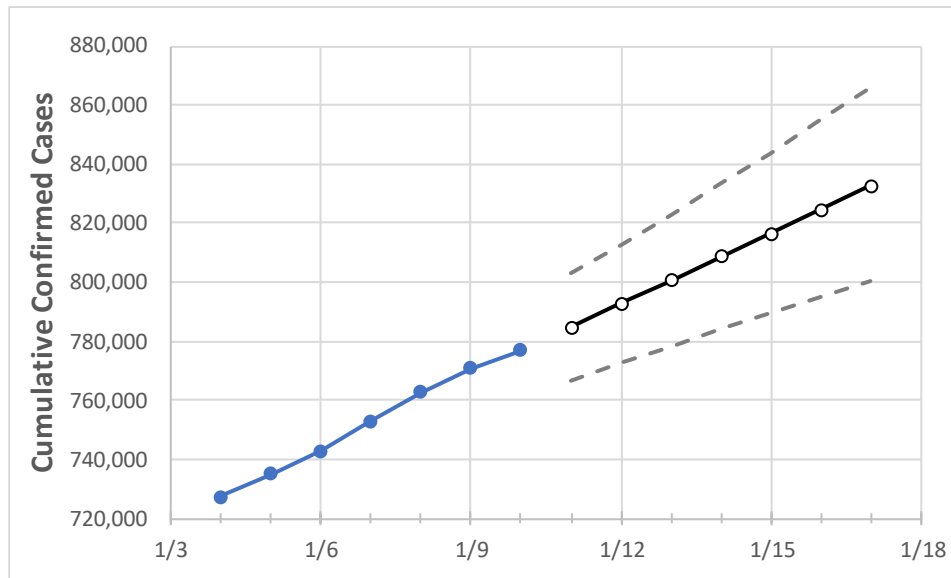
	Actual Confirmed Cases On:				Projected Cases For:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Ohio	753,068	762,603	770,977	777,065	784,792	792,679	800,696	808,606	816,557	824,696	832,635

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Athens	3,295	3,340	3,377	3,399	3,432	3,465	3,499	3,533	3,568	3,602	3,637
Cuyahoga	75,120	75,837	76,667	77,359	78,051	78,755	79,452	80,150	80,837	81,528	82,205
Franklin	89,439	90,416	91,391	92,060	92,873	93,678	94,485	95,282	96,096	96,905	97,725
Hamilton	55,652	56,256	56,947	57,384	57,953	58,527	59,116	59,704	60,310	60,897	61,503
Lake	13,887	14,050	14,201	14,319	14,486	14,649	14,818	14,986	15,158	15,334	15,506
Lorain	16,187	16,425	16,612	16,771	16,971	17,171	17,373	17,573	17,775	17,978	18,182
Lucas	27,608	27,940	28,189	28,506	28,779	29,052	29,328	29,605	29,879	30,161	30,442
Mahoning	15,684	15,818	15,904	15,983	16,088	16,190	16,287	16,385	16,482	16,576	16,672
Medina	10,102	10,227	10,349	10,435	10,549	10,667	10,787	10,904	11,024	11,143	11,264
Miami	8,116	8,229	8,323	8,392	8,471	8,551	8,631	8,712	8,793	8,877	8,959
Summit	30,134	30,571	30,858	31,089	31,388	31,692	31,978	32,280	32,574	32,870	33,159

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:		
	1/7	1/8	1/9	1/10	1/12	1/14	1/16
Athens	3,295	3,340	3,377	3,399	3,465 (693) [166] {83}	3,533 (707) [170] {85}	3,602 (720) [173] {86}
Cuyahoga	75,120	75,837	76,667	77,359	78,755 (15,751) [3,780] {1,890}	80,150 (16,030) [3,847] {1,924}	81,528 (16,306) [3,913] {1,957}
Franklin	89,439	90,416	91,391	92,060	93,678 (18,736) [4,497] {2,248}	95,282 (19,056) [4,574] {2,287}	96,905 (19,381) [4,651] {2,326}
Hamilton	55,652	56,256	56,947	57,384	58,527 (11,705) [2,809] {1,405}	59,704 (11,941) [2,866] {1,433}	60,897 (12,179) [2,923] {1,462}
Lake	13,887	14,050	14,201	14,319	14,649 (2,930) [703] {352}	14,986 (2,997) [719] {360}	15,334 (3,067) [736] {368}
Lorain	16,187	16,425	16,612	16,771	17,171 (3,434) [824] {412}	17,573 (3,515) [843] {422}	17,978 (3,596) [863] {431}
Lucas	27,608	27,940	28,189	28,506	29,052 (5,810) [1,394] {697}	29,605 (5,921) [1,421] {711}	30,161 (6,032) [1,448] {724}
Mahoning	15,684	15,818	15,904	15,983	16,190 (3,238) [777] {389}	16,385 (3,277) [786] {393}	16,576 (3,315) [796] {398}
Medina	10,102	10,227	10,349	10,435	10,667 (2,133) [512] {256}	10,904 (2,181) [523] {262}	11,143 (2,229) [535] {267}
Miami	8,116	8,229	8,323	8,392	8,551 (1,710) [410] {205}	8,712 (1,742) [418] {209}	8,877 (1,775) [426] {213}
Summit	30,134	30,571	30,858	31,089	31,692 (6,338) [1,521] {761}	32,280 (6,456) [1,549] {775}	32,870 (6,574) [1,578] {789}

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.