IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/7/21

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 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 4/7/21 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
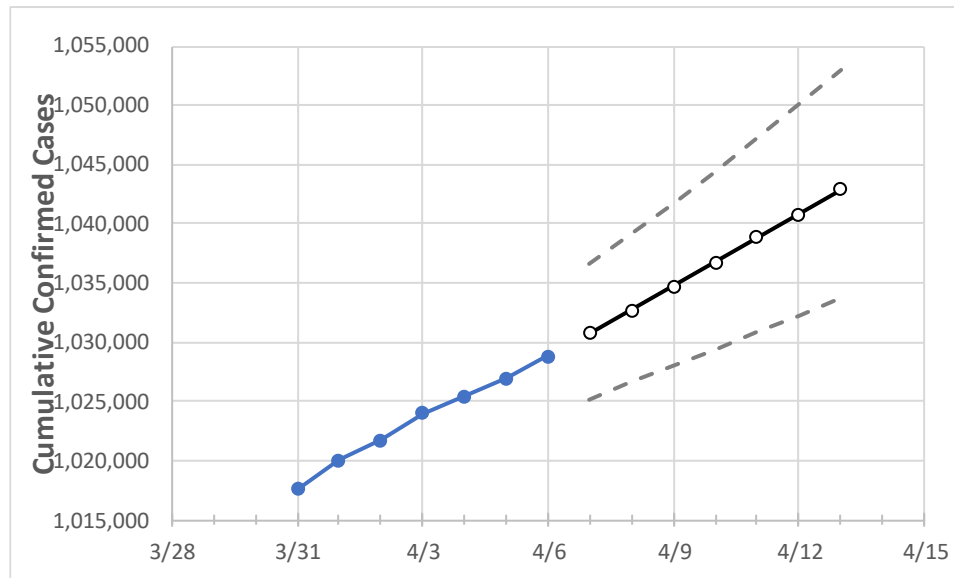
	Actual Confirmed Cases On:				Projected Cases For:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Ohio	1,024,011	1,025,470	1,026,929	1,028,800	1,030,753	1,032,705	1,034,752	1,036,775	1,038,815	1,040,831	1,042,893

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Athens	4,863	4,869	4,874	4,887	4,897	4,907	4,917	4,927	4,938	4,948	4,959
Cuyahoga	102,868	103,079	103,289	103,578	103,851	104,131	104,419	104,711	105,006	105,307	105,612
Franklin	118,657	118,849	119,040	119,303	119,567	119,835	120,107	120,378	120,659	120,936	121,221
Hamilton	76,740	76,818	76,896	76,986	77,084	77,183	77,279	77,377	77,475	77,574	77,673
Lake	19,370	19,404	19,438	19,494	19,536	19,578	19,622	19,666	19,711	19,758	19,806
Lorain	23,400	23,433	23,465	23,511	23,563	23,616	23,669	23,725	23,778	23,834	23,890
Lucas	38,282	38,371	38,460	38,545	38,664	38,789	38,911	39,039	39,168	39,300	39,433
Mahoning	20,372	20,397	20,421	20,463	20,504	20,545	20,589	20,634	20,679	20,725	20,770
Medina	14,464	14,485	14,506	14,525	14,554	14,582	14,610	14,639	14,666	14,694	14,721
Miami	10,373	10,380	10,386	10,394	10,404	10,415	10,425	10,436	10,446	10,456	10,467
Summit	43,639	43,754	43,868	43,976	44,103	44,231	44,360	44,492	44,623	44,758	44,892

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:		
	4/3	4/4	4/5	4/6	4/8	4/10	4/12
Athens	4,863	4,869	4,874	4,887	4,907 (981) [236] {118}	4,927 (985) [237] {118}	4,948 (990) [238] {119}
Cuyahoga	102,868	103,079	103,289	103,578	104,131 (20,826) [4,998] {2,499}	104,711 (20,942) [5,026] {2,513}	105,307 (21,061) [5,055] {2,527}
Franklin	118,657	118,849	119,040	119,303	119,835 (23,967) [5,752] {2,876}	120,378 (24,076) [5,778] {2,889}	120,936 (24,187) [5,805] {2,902}
Hamilton	76,740	76,818	76,896	76,986	77,183 (15,437) [3,705] {1,852}	77,377 (15,475) [3,714] {1,857}	77,574 (15,515) [3,724] {1,862}
Lake	19,370	19,404	19,438	19,494	19,578 (3,916) [940] {470}	19,666 (3,933) [944] {472}	19,758 (3,952) [948] {474}
Lorain	23,400	23,433	23,465	23,511	23,616 (4,723) [1,134] {567}	23,725 (4,745) [1,139] {569}	23,834 (4,767) [1,144] {572}
Lucas	38,282	38,371	38,460	38,545	38,789 (7,758) [1,862] {931}	39,039 (7,808) [1,874] {937}	39,300 (7,860) [1,886] {943}
Mahoning	20,372	20,397	20,421	20,463	20,545 (4,109) [986] {493}	20,634 (4,127) [990] {495}	20,725 (4,145) [995] {497}
Medina	14,464	14,485	14,506	14,525	14,582 (2,916) [700] {350}	14,639 (2,928) [703] {351}	14,694 (2,939) [705] {353}
Miami	10,373	10,380	10,386	10,394	10,415 (2,083) [500] {250}	10,436 (2,087) [501] {250}	10,456 (2,091) [502] {251}
Summit	43,639	43,754	43,868	43,976	44,231 (8,846) [2,123] {1,062}	44,492 (8,898) [2,136] {1,068}	44,758 (8,952) [2,148] {1,074}

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.