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

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 7/21/21 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
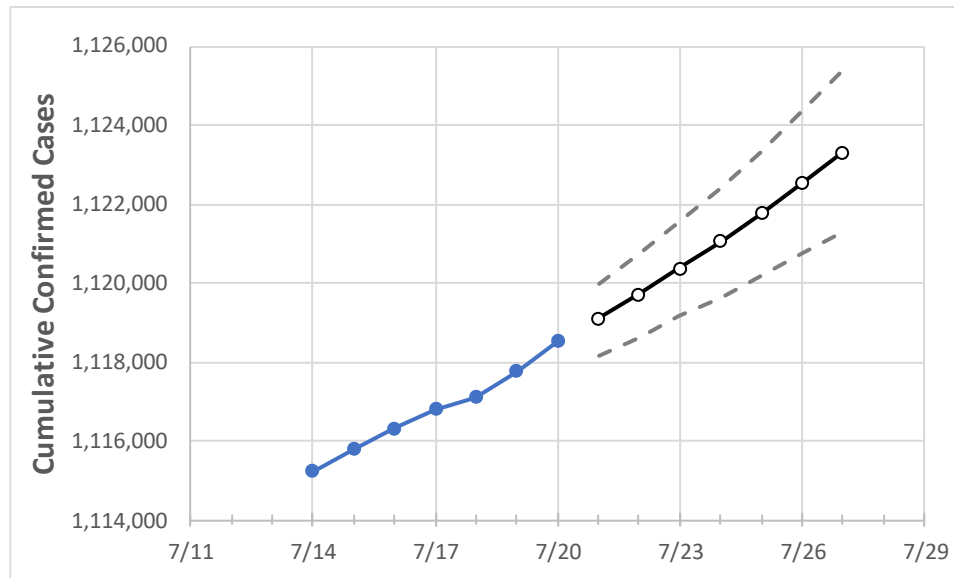
	Actual Confirmed Cases On:				Projected Cases For:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Ohio	1,116,808	1,117,109	1,117,769	1,118,513	1,119,093	1,119,721	1,120,369	1,121,046	1,121,766	1,122,526	1,123,321

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Athens	5,255	5,255	5,256	5,256	5,257	5,258	5,259	5,260	5,261	5,262	5,262
Cuyahoga	116,585	116,617	116,668	116,771	116,826	116,882	116,942	117,004	117,068	117,138	117,209
Franklin	129,696	129,725	129,764	129,828	129,877	129,927	129,979	130,032	130,089	130,148	130,207
Hamilton	81,907	81,926	81,955	82,000	82,039	82,080	82,122	82,166	82,211	82,260	82,311
Lake	21,359	21,361	21,365	21,383	21,395	21,406	21,419	21,432	21,446	21,460	21,475
Lorain	25,818	25,826	25,840	25,859	25,871	25,883	25,896	25,910	25,925	25,941	25,957
Lucas	43,562	43,570	43,587	43,605	43,620	43,635	43,652	43,669	43,687	43,706	43,725
Mahoning	22,487	22,499	22,621	22,636	22,643	22,651	22,659	22,668	22,676	22,685	22,695
Medina	15,730	15,739	15,744	15,761	15,770	15,780	15,789	15,800	15,811	15,822	15,833
Miami	10,920	10,923	10,929	10,935	10,940	10,946	10,952	10,959	10,965	10,973	10,980
Summit	48,689	48,699	48,719	48,733	48,750	48,768	48,786	48,806	48,826	48,847	48,869

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:		
	7/17	7/18	7/19	7/20	7/22	7/24	7/26
Athens	5,255	5,255	5,256	5,256	5,258 (1,052) [252] {126}	5,260 (1,052) [252] {126}	5,262 (1,052) [253] {126}
Cuyahoga	116,585	116,617	116,668	116,771	116,882 (23,376) [5,610] {2,805}	117,004 (23,401) [5,616] {2,808}	117,138 (23,428) [5,623] {2,811}
Franklin	129,696	129,725	129,764	129,828	129,927 (25,985) [6,237] {3,118}	130,032 (26,006) [6,242] {3,121}	130,148 (26,030) [6,247] {3,124}
Hamilton	81,907	81,926	81,955	82,000	82,080 (16,416) [3,940] {1,970}	82,166 (16,433) [3,944] {1,972}	82,260 (16,452) [3,948] {1,974}
Lake	21,359	21,361	21,365	21,383	21,406 (4,281) [1,028] {514}	21,432 (4,286) [1,029] {514}	21,460 (4,292) [1,030] {515}
Lorain	25,818	25,826	25,840	25,859	25,883 (5,177) [1,242] {621}	25,910 (5,182) [1,244] {622}	25,941 (5,188) [1,245] {623}
Lucas	43,562	43,570	43,587	43,605	43,635 (8,727) [2,094] {1,047}	43,669 (8,734) [2,096] {1,048}	43,706 (8,741) [2,098] {1,049}
Mahoning	22,487	22,499	22,621	22,636	22,651 (4,530) [1,087] {544}	22,668 (4,534) [1,088] {544}	22,685 (4,537) [1,089] {544}
Medina	15,730	15,739	15,744	15,761	15,780 (3,156) [757] {379}	15,800 (3,160) [758] {379}	15,822 (3,164) [759] {380}
Miami	10,920	10,923	10,929	10,935	10,946 (2,189) [525] {263}	10,959 (2,192) [526] {263}	10,973 (2,195) [527] {263}
Summit	48,689	48,699	48,719	48,733	48,768 (9,754) [2,341] {1,170}	48,806 (9,761) [2,343] {1,171}	48,847 (9,769) [2,345] {1,172}

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.