IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/9/21

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 2/9/21 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
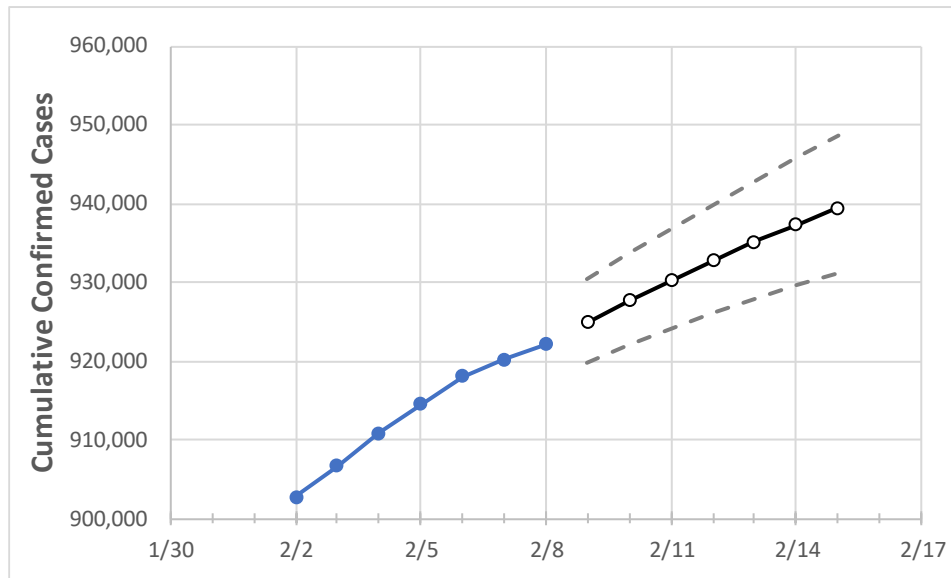
	Actual Confirmed Cases On:				Projected Cases For:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
Ohio	914,530	918,079	920,217	922,143	924,954	927,647	930,254	932,728	935,099	937,356	939,514

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:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
Athens	4,189	4,215	4,221	4,230	4,255	4,280	4,305	4,328	4,352	4,375	4,398
Cuyahoga	90,623	90,900	91,144	91,318	91,555	91,785	92,005	92,218	92,414	92,606	92,787
Franklin	106,526	106,893	107,107	107,282	107,537	107,786	108,029	108,255	108,472	108,685	108,891
Hamilton	68,885	69,226	69,411	69,562	69,832	70,088	70,334	70,576	70,812	71,044	71,261
Lake	17,220	17,288	17,340	17,371	17,432	17,491	17,547	17,601	17,653	17,705	17,754
Lorain	20,505	20,610	20,672	20,717	20,791	20,863	20,932	20,997	21,060	21,123	21,183
Lucas	33,215	33,333	33,414	33,471	33,563	33,653	33,737	33,820	33,897	33,972	34,044
Mahoning	18,390	18,441	18,470	18,530	18,591	18,648	18,707	18,763	18,817	18,869	18,921
Medina	12,464	12,522	12,557	12,592	12,643	12,693	12,739	12,785	12,830	12,874	12,918
Miami	9,621	9,649	9,673	9,684	9,708	9,730	9,752	9,773	9,794	9,814	9,833
Summit	37,327	37,485	37,622	37,749	37,895	38,039	38,181	38,320	38,454	38,584	38,710

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:		
	2/5	2/6	2/7	2/8	2/10	2/12	2/14
Athens	4,189	4,215	4,221	4,230	4,280 (856) [205] {103}	4,328 (866) [208] {104}	4,375 (875) [210] {105}
Cuyahoga	90,623	90,900	91,144	91,318	91,785 (18,357) [4,406] {2,203}	92,218 (18,444) [4,426] {2,213}	92,606 (18,521) [4,445] {2,223}
Franklin	106,526	106,893	107,107	107,282	107,786 (21,557) [5,174] {2,587}	108,255 (21,651) [5,196] {2,598}	108,685 (21,737) [5,217] {2,608}
Hamilton	68,885	69,226	69,411	69,562	70,088 (14,018) [3,364] {1,682}	70,576 (14,115) [3,388] {1,694}	71,044 (14,209) [3,410] {1,705}
Lake	17,220	17,288	17,340	17,371	17,491 (3,498) [840] {420}	17,601 (3,520) [845] {422}	17,705 (3,541) [850] {425}
Lorain	20,505	20,610	20,672	20,717	20,863 (4,173) [1,001] {501}	20,997 (4,199) [1,008] {504}	21,123 (4,225) [1,014] {507}
Lucas	33,215	33,333	33,414	33,471	33,653 (6,731) [1,615] {808}	33,820 (6,764) [1,623] {812}	33,972 (6,794) [1,631] {815}
Mahoning	18,390	18,441	18,470	18,530	18,648 (3,730) [895] {448}	18,763 (3,753) [901] {450}	18,869 (3,774) [906] {453}
Medina	12,464	12,522	12,557	12,592	12,693 (2,539) [609] {305}	12,785 (2,557) [614] {307}	12,874 (2,575) [618] {309}
Miami	9,621	9,649	9,673	9,684	9,730 (1,946) [467] {234}	9,773 (1,955) [469] {235}	9,814 (1,963) [471] {236}
Summit	37,327	37,485	37,622	37,749	38,039 (7,608) [1,826] {913}	38,320 (7,664) [1,839] {920}	38,584 (7,717) [1,852] {926}

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.