IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/2/21

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 4/2/21 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
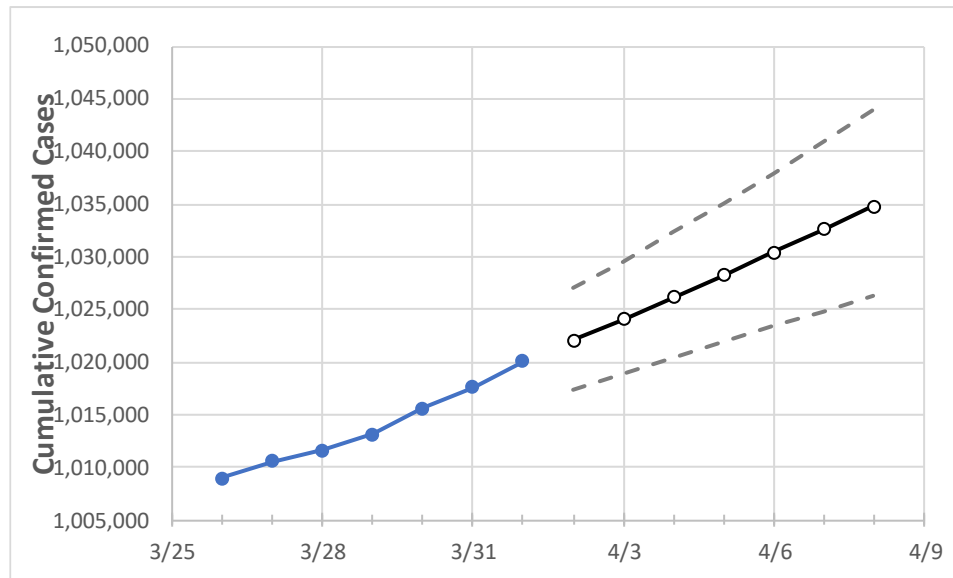
	Actual Confirmed Cases On:				Projected Cases For:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Ohio	1,013,119	1,015,577	1,017,566	1,020,041	1,022,023	1,024,041	1,026,123	1,028,245	1,030,372	1,032,580	1,034,778

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Athens	4,808	4,820	4,825	4,840	4,848	4,856	4,864	4,873	4,881	4,890	4,899
Cuyahoga	101,402	101,722	101,978	102,290	102,549	102,817	103,088	103,362	103,647	103,939	104,234
Franklin	117,227	117,583	117,832	118,171	118,441	118,714	118,997	119,284	119,579	119,873	120,170
Hamilton	76,137	76,271	76,362	76,528	76,637	76,749	76,860	76,971	77,083	77,198	77,310
Lake	19,169	19,199	19,238	19,288	19,318	19,349	19,379	19,411	19,442	19,474	19,507
Lorain	23,109	23,177	23,229	23,285	23,342	23,400	23,460	23,520	23,582	23,644	23,708
Lucas	37,624	37,779	37,894	38,036	38,164	38,297	38,434	38,574	38,721	38,869	39,023
Mahoning	20,158	20,195	20,233	20,275	20,313	20,353	20,393	20,435	20,476	20,520	20,565
Medina	14,283	14,317	14,349	14,386	14,417	14,449	14,480	14,513	14,546	14,577	14,610
Miami	10,310	10,326	10,335	10,346	10,358	10,370	10,382	10,395	10,407	10,420	10,433
Summit	42,977	43,123	43,243	43,396	43,527	43,660	43,797	43,937	44,080	44,228	44,376

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Athens	4,808	4,820	4,825	4,840	4,856 (971) [233] {117}	4,873 (975) [234] {117}	4,890 (978) [235] {117}
Cuyahoga	101,402	101,722	101,978	102,290	102,817 (20,563) [4,935] {2,468}	103,362 (20,672) [4,961] {2,481}	103,939 (20,788) [4,989] {2,495}
Franklin	117,227	117,583	117,832	118,171	118,714 (23,743) [5,698] {2,849}	119,284 (23,857) [5,726] {2,863}	119,873 (23,975) [5,754] {2,877}
Hamilton	76,137	76,271	76,362	76,528	76,749 (15,350) [3,684] {1,842}	76,971 (15,394) [3,695] {1,847}	77,198 (15,440) [3,705] {1,853}
Lake	19,169	19,199	19,238	19,288	19,349 (3,870) [929] {464}	19,411 (3,882) [932] {466}	19,474 (3,895) [935] {467}
Lorain	23,109	23,177	23,229	23,285	23,400 (4,680) [1,123] {562}	23,520 (4,704) [1,129] {564}	23,644 (4,729) [1,135] {567}
Lucas	37,624	37,779	37,894	38,036	38,297 (7,659) [1,838] {919}	38,574 (7,715) [1,852] {926}	38,869 (7,774) [1,866] {933}
Mahoning	20,158	20,195	20,233	20,275	20,353 (4,071) [977] {488}	20,435 (4,087) [981] {490}	20,520 (4,104) [985] {492}
Medina	14,283	14,317	14,349	14,386	14,449 (2,890) [694] {347}	14,513 (2,903) [697] {348}	14,577 (2,915) [700] {350}
Miami	10,310	10,326	10,335	10,346	10,370 (2,074) [498] {249}	10,395 (2,079) [499] {249}	10,420 (2,084) [500] {250}
Summit	42,977	43,123	43,243	43,396	43,660 (8,732) [2,096] {1,048}	43,937 (8,787) [2,109] {1,054}	44,228 (8,846) [2,123] {1,061}

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.