IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/15/21

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 1/15/21 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
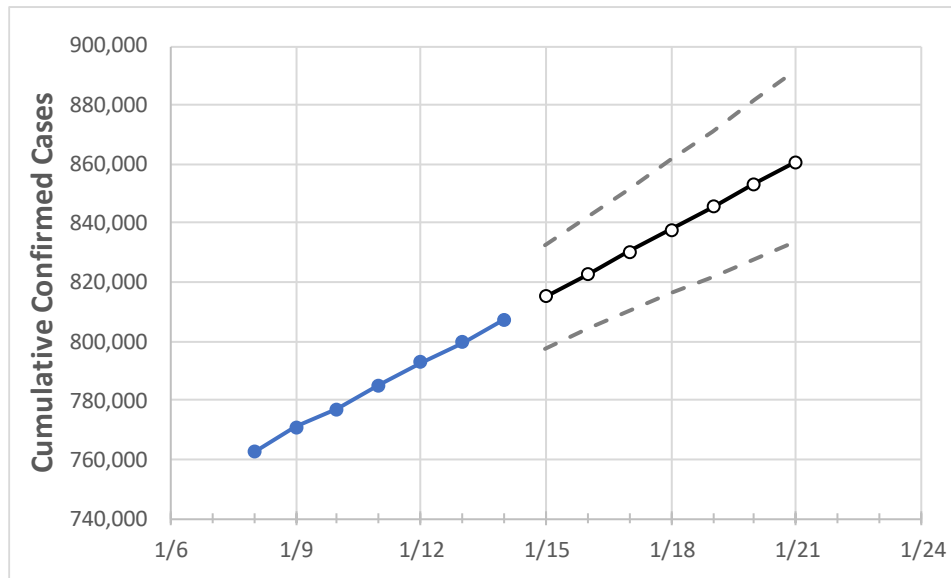
	Actual Confirmed Cases On:				Projected Cases For:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Ohio	784,957	792,938	799,639	807,293	815,003	822,620	830,212	837,722	845,477	853,202	860,897

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Athens	3,434	3,481	3,505	3,546	3,581	3,617	3,654	3,691	3,729	3,768	3,807
Cuyahoga	78,231	78,970	79,634	80,262	80,961	81,655	82,361	83,052	83,738	84,438	85,129
Franklin	93,057	93,903	94,591	95,508	96,337	97,166	98,013	98,852	99,696	100,534	101,401
Hamilton	57,879	58,503	59,040	59,783	60,408	61,033	61,667	62,321	62,972	63,634	64,301
Lake	14,461	14,621	14,769	14,941	15,101	15,260	15,424	15,590	15,754	15,918	16,083
Lorain	17,071	17,196	17,335	17,563	17,758	17,954	18,148	18,341	18,536	18,730	18,918
Lucas	28,841	29,047	29,249	29,495	29,758	30,018	30,284	30,547	30,810	31,078	31,341
Mahoning	16,104	16,219	16,299	16,430	16,531	16,630	16,728	16,825	16,918	17,013	17,104
Medina	10,551	10,632	10,737	10,815	10,918	11,020	11,121	11,223	11,323	11,422	11,520
Miami	8,454	8,553	8,621	8,673	8,748	8,824	8,899	8,974	9,049	9,124	9,198
Summit	31,539	31,877	32,195	32,488	32,805	33,120	33,436	33,747	34,066	34,397	34,723

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:		
	1/11	1/12	1/13	1/14	1/16	1/18	1/20
Athens	3,434	3,481	3,505	3,546	3,617 (723) [174] {87}	3,691 (738) [177] {89}	3,768 (754) [181] {90}
Cuyahoga	78,231	78,970	79,634	80,262	81,655 (16,331) [3,919] {1,960}	83,052 (16,610) [3,986] {1,993}	84,438 (16,888) [4,053] {2,027}
Franklin	93,057	93,903	94,591	95,508	97,166 (19,433) [4,664] {2,332}	98,852 (19,770) [4,745] {2,372}	100,534 (20,107) [4,826] {2,413}
Hamilton	57,879	58,503	59,040	59,783	61,033 (12,207) [2,930] {1,465}	62,321 (12,464) [2,991] {1,496}	63,634 (12,727) [3,054] {1,527}
Lake	14,461	14,621	14,769	14,941	15,260 (3,052) [732] {366}	15,590 (3,118) [748] {374}	15,918 (3,184) [764] {382}
Lorain	17,071	17,196	17,335	17,563	17,954 (3,591) [862] {431}	18,341 (3,668) [880] {440}	18,730 (3,746) [899] {450}
Lucas	28,841	29,047	29,249	29,495	30,018 (6,004) [1,441] {720}	30,547 (6,109) [1,466] {733}	31,078 (6,216) [1,492] {746}
Mahoning	16,104	16,219	16,299	16,430	16,630 (3,326) [798] {399}	16,825 (3,365) [808] {404}	17,013 (3,403) [817] {408}
Medina	10,551	10,632	10,737	10,815	11,020 (2,204) [529] {264}	11,223 (2,245) [539] {269}	11,422 (2,284) [548] {274}
Miami	8,454	8,553	8,621	8,673	8,824 (1,765) [424] {212}	8,974 (1,795) [431] {215}	9,124 (1,825) [438] {219}
Summit	31,539	31,877	32,195	32,488	33,120 (6,624) [1,590] {795}	33,747 (6,749) [1,620] {810}	34,397 (6,879) [1,651] {826}

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.