IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/24/21

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 3/24/21 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.

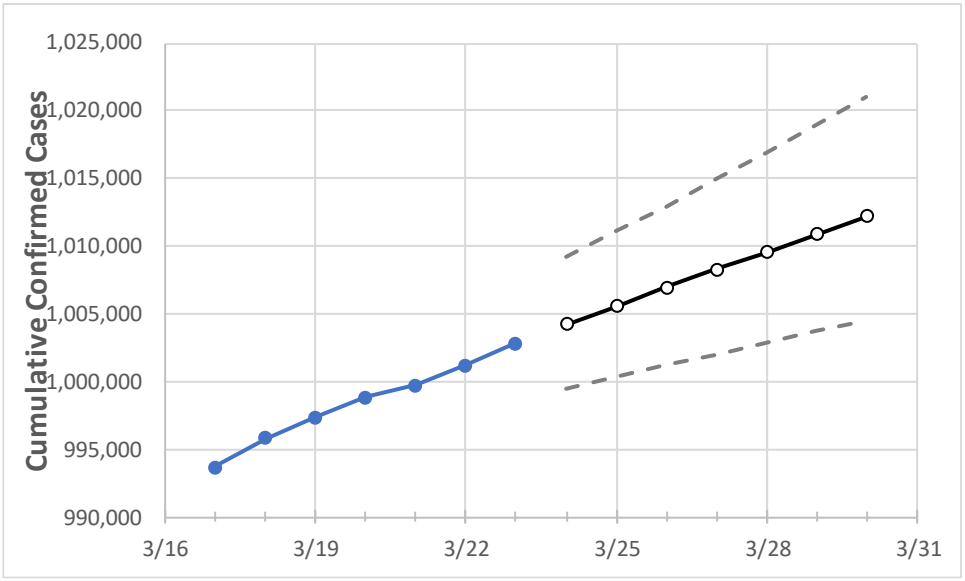
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Ohio	998,819	999,750	1,001,194	1,002,822	1,004,216	1,005,591	1,006,953	1,008,269	1,009,573	1,010,909	1,012,233

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Athens	4,750	4,753	4,760	4,764	4,769	4,775	4,780	4,785	4,790	4,794	4,799
Cuyahoga	99,528	99,616	99,848	100,059	100,236	100,410	100,588	100,759	100,939	101,108	101,282
Franklin	115,433	115,553	115,731	115,937	116,110	116,283	116,456	116,625	116,804	116,977	117,147
Hamilton	75,305	75,383	75,464	75,574	75,671	75,767	75,863	75,957	76,052	76,146	76,239
Lake	18,930	18,946	18,970	18,991	19,012	19,032	19,052	19,071	19,091	19,109	19,128
Lorain	22,679	22,703	22,758	22,810	22,845	22,881	22,916	22,952	22,989	23,025	23,062
Lucas	36,804	36,838	36,896	36,983	37,046	37,109	37,170	37,230	37,289	37,348	37,404
Mahoning	19,892	19,914	19,936	19,960	19,982	20,004	20,025	20,047	20,068	20,089	20,111
Medina	14,018	14,037	14,065	14,095	14,129	14,163	14,196	14,230	14,264	14,299	14,333
Miami	10,201	10,208	10,221	10,242	10,253	10,265	10,276	10,287	10,299	10,310	10,321
Summit	41,997	42,065	42,161	42,268	42,368	42,469	42,571	42,672	42,772	42,873	42,974

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Athens	4,750	4,753	4,760	4,764	4,775 (955) [229] {115}	4,785 (957) [230] {115}	4,794 (959) [230] {115}
Cuyahoga	99,528	99,616	99,848	100,059	100,410 (20,082) [4,820] {2,410}	100,759 (20,152) [4,836] {2,418}	101,108 (20,222) [4,853] {2,427}
Franklin	115,433	115,553	115,731	115,937	116,283 (23,257) [5,582] {2,791}	116,625 (23,325) [5,598] {2,799}	116,977 (23,395) [5,615] {2,807}
Hamilton	75,305	75,383	75,464	75,574	75,767 (15,153) [3,637] {1,818}	75,957 (15,191) [3,646] {1,823}	76,146 (15,229) [3,655] {1,828}
Lake	18,930	18,946	18,970	18,991	19,032 (3,806) [914] {457}	19,071 (3,814) [915] {458}	19,109 (3,822) [917] {459}
Lorain	22,679	22,703	22,758	22,810	22,881 (4,576) [1,098] {549}	22,952 (4,590) [1,102] {551}	23,025 (4,605) [1,105] {553}
Lucas	36,804	36,838	36,896	36,983	37,109 (7,422) [1,781] {891}	37,230 (7,446) [1,787] {894}	37,348 (7,470) [1,793] {896}
Mahoning	19,892	19,914	19,936	19,960	20,004 (4,001) [960] {480}	20,047 (4,009) [962] {481}	20,089 (4,018) [964] {482}
Medina	14,018	14,037	14,065	14,095	14,163 (2,833) [680] {340}	14,230 (2,846) [683] {342}	14,299 (2,860) [686] {343}
Miami	10,201	10,208	10,221	10,242	10,265 (2,053) [493] {246}	10,287 (2,057) [494] {247}	10,310 (2,062) [495] {247}
Summit	41,997	42,065	42,161	42,268	42,469 (8,494) [2,038] {1,019}	42,672 (8,534) [2,048] {1,024}	42,873 (8,575) [2,058] {1,029}

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.