IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/25/21

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 3/25/21 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.
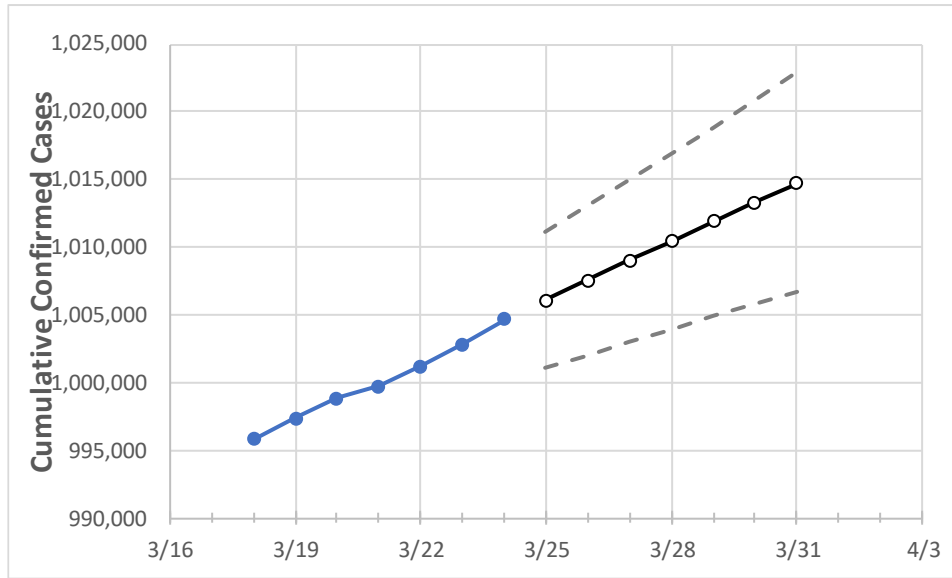
IEM's Modeling Lead

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Ohio	999,750	1,001,194	1,002,822	1,004,670	1,006,095	1,007,548	1,009,008	1,010,436	1,011,901	1,013,324	1,014,693

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Athens	4,753	4,760	4,764	4,769	4,774	4,779	4,785	4,790	4,795	4,799	4,804
Cuyahoga	99,616	99,848	100,059	100,328	100,510	100,698	100,892	101,072	101,261	101,449	101,632
Franklin	115,553	115,731	115,937	116,117	116,291	116,460	116,632	116,803	116,977	117,141	117,310
Hamilton	75,383	75,464	75,574	75,684	75,781	75,878	75,973	76,069	76,165	76,260	76,355
Lake	18,946	18,970	18,991	19,021	19,042	19,063	19,083	19,103	19,123	19,142	19,161
Lorain	22,703	22,758	22,810	22,883	22,922	22,962	23,002	23,042	23,083	23,123	23,165
Lucas	36,838	36,896	36,983	37,090	37,158	37,226	37,294	37,360	37,425	37,490	37,554
Mahoning	19,914	19,936	19,960	19,989	20,013	20,036	20,060	20,083	20,106	20,130	20,153
Medina	14,037	14,065	14,095	14,128	14,160	14,192	14,224	14,257	14,290	14,322	14,356
Miami	10,208	10,221	10,242	10,256	10,267	10,278	10,290	10,301	10,313	10,325	10,337
Summit	42,065	42,161	42,268	42,375	42,477	42,578	42,679	42,780	42,883	42,988	43,091

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:		
	3/21	3/22	3/23	3/24	3/26	3/28	3/30
Athens	4,753	4,760	4,764	4,769	4,779 (956) [229] {115}	4,790 (958) [230] {115}	4,799 (960) [230] {115}
Cuyahoga	99,616	99,848	100,059	100,328	100,698 (20,140) [4,834] {2,417}	101,072 (20,214) [4,851] {2,426}	101,449 (20,290) [4,870] {2,435}
Franklin	115,553	115,731	115,937	116,117	116,460 (23,292) [5,590] {2,795}	116,803 (23,361) [5,607] {2,803}	117,141 (23,428) [5,623] {2,811}
Hamilton	75,383	75,464	75,574	75,684	75,878 (15,176) [3,642] {1,821}	76,069 (15,214) [3,651] {1,826}	76,260 (15,252) [3,660] {1,830}
Lake	18,946	18,970	18,991	19,021	19,063 (3,813) [915] {458}	19,103 (3,821) [917] {458}	19,142 (3,828) [919] {459}
Lorain	22,703	22,758	22,810	22,883	22,962 (4,592) [1,102] {551}	23,042 (4,608) [1,106] {553}	23,123 (4,625) [1,110] {555}
Lucas	36,838	36,896	36,983	37,090	37,226 (7,445) [1,787] {893}	37,360 (7,472) [1,793] {897}	37,490 (7,498) [1,800] {900}
Mahoning	19,914	19,936	19,960	19,989	20,036 (4,007) [962] {481}	20,083 (4,017) [964] {482}	20,130 (4,026) [966] {483}
Medina	14,037	14,065	14,095	14,128	14,192 (2,838) [681] {341}	14,257 (2,851) [684] {342}	14,322 (2,864) [687] {344}
Miami	10,208	10,221	10,242	10,256	10,278 (2,056) [493] {247}	10,301 (2,060) [494] {247}	10,325 (2,065) [496] {248}
Summit	42,065	42,161	42,268	42,375	42,578 (8,516) [2,044] {1,022}	42,780 (8,556) [2,053] {1,027}	42,988 (8,598) [2,063] {1,032}

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.