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

Date: 3/16/21

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 3/16/21 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.

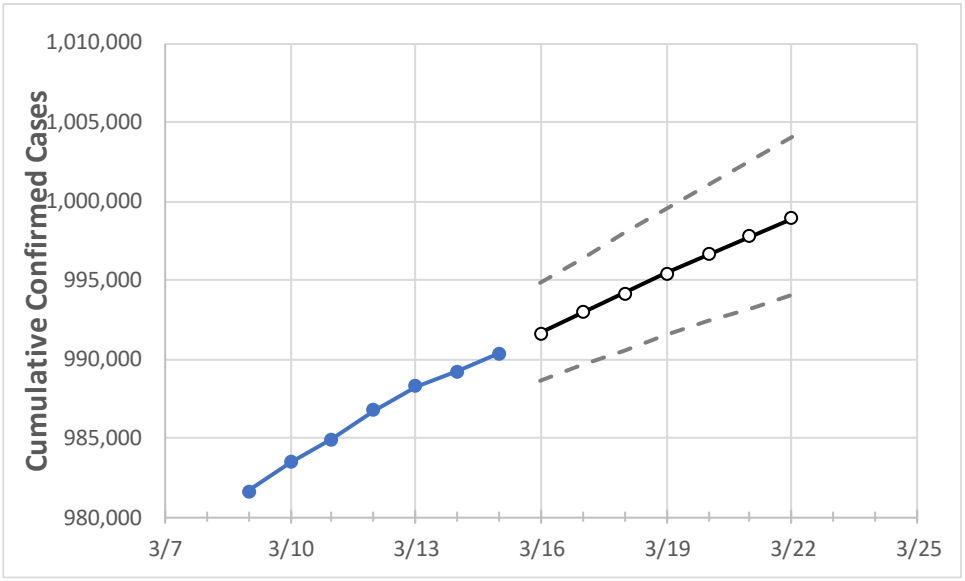
IEM's Modeling Lead

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:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Ohio	986,740	988,298	989,191	990,340	991,643	992,931	994,183	995,423	996,621	997,751	998,874

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:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Athens	4,697	4,701	4,710	4,711	4,715	4,718	4,721	4,724	4,727	4,730	4,733
Cuyahoga	97,975	98,207	98,295	98,473	98,655	98,835	99,011	99,186	99,360	99,532	99,704
Franklin	113,992	114,206	114,335	114,458	114,615	114,768	114,921	115,072	115,221	115,366	115,510
Hamilton	74,464	74,571	74,636	74,704	74,782	74,859	74,935	75,008	75,078	75,146	75,212
Lake	18,724	18,763	18,789	18,809	18,835	18,861	18,886	18,911	18,935	18,959	18,984
Lorain	22,425	22,463	22,477	22,504	22,534	22,563	22,592	22,620	22,647	22,673	22,699
Lucas	36,254	36,319	36,357	36,422	36,497	36,574	36,648	36,721	36,795	36,869	36,943
Mahoning	19,699	19,726	19,751	19,777	19,796	19,813	19,831	19,848	19,864	19,881	19,896
Medina	13,728	13,783	13,799	13,818	13,846	13,875	13,904	13,933	13,960	13,989	14,017
Miami	10,102	10,112	10,116	10,130	10,137	10,144	10,150	10,157	10,163	10,169	10,175
Summit	41,191	41,315	41,378	41,459	41,541	41,622	41,702	41,784	41,863	41,940	42,016

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:		
	3/12	3/13	3/14	3/15	3/17	3/19	3/21
Athens	4,697	4,701	4,710	4,711	4,718 (944) [226] {113}	4,724 (945) [227] {113}	4,730 (946) [227] {114}
Cuyahoga	97,975	98,207	98,295	98,473	98,835 (19,767) [4,744] {2,372}	99,186 (19,837) [4,761] {2,380}	99,532 (19,906) [4,778] {2,389}
Franklin	113,992	114,206	114,335	114,458	114,768 (22,954) [5,509] {2,754}	115,072 (23,014) [5,523] {2,762}	115,366 (23,073) [5,538] {2,769}
Hamilton	74,464	74,571	74,636	74,704	74,859 (14,972) [3,593] {1,797}	75,008 (15,002) [3,600] {1,800}	75,146 (15,029) [3,607] {1,803}
Lake	18,724	18,763	18,789	18,809	18,861 (3,772) [905] {453}	18,911 (3,782) [908] {454}	18,959 (3,792) [910] {455}
Lorain	22,425	22,463	22,477	22,504	22,563 (4,513) [1,083] {542}	22,620 (4,524) [1,086] {543}	22,673 (4,535) [1,088] {544}
Lucas	36,254	36,319	36,357	36,422	36,574 (7,315) [1,756] {878}	36,721 (7,344) [1,763] {881}	36,869 (7,374) [1,770] {885}
Mahoning	19,699	19,726	19,751	19,777	19,813 (3,963) [951] {476}	19,848 (3,970) [953] {476}	19,881 (3,976) [954] {477}
Medina	13,728	13,783	13,799	13,818	13,875 (2,775) [666] {333}	13,933 (2,787) [669] {334}	13,989 (2,798) [671] {336}
Miami	10,102	10,112	10,116	10,130	10,144 (2,029) [487] {243}	10,157 (2,031) [488] {244}	10,169 (2,034) [488] {244}
Summit	41,191	41,315	41,378	41,459	41,622 (8,324) [1,998] {999}	41,784 (8,357) [2,006] {1,003}	41,940 (8,388) [2,013] {1,007}

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.