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

Date: 3/15/21

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 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 3/15/21 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.

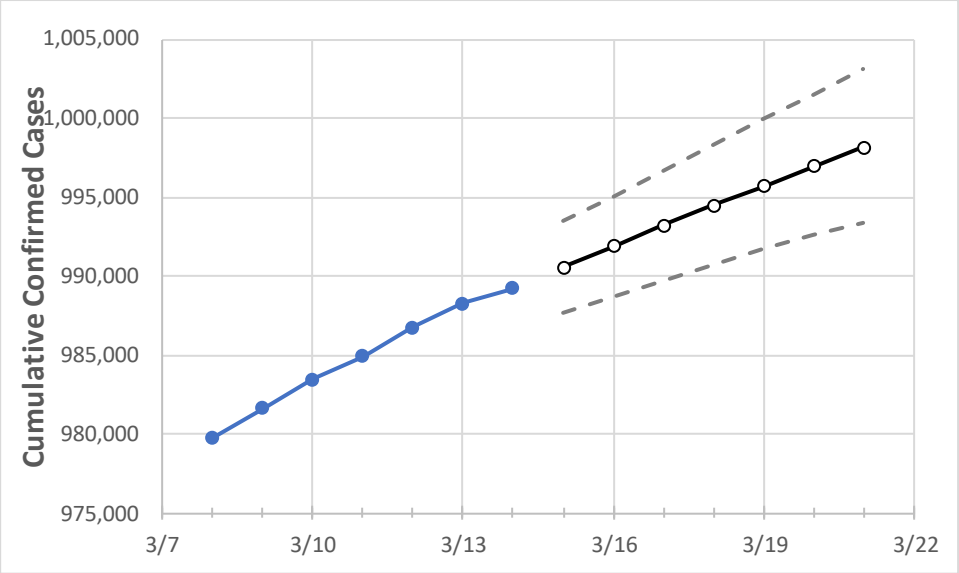
IEM's Modeling Lead

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Ohio	984,934	986,740	988,298	989,191	990,534	991,873	993,182	994,454	995,691	996,932	998,134

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Athens	4,686	4,697	4,701	4,710	4,714	4,717	4,721	4,724	4,727	4,730	4,732
Cuyahoga	97,792	97,975	98,207	98,295	98,480	98,665	98,847	99,027	99,205	99,381	99,555
Franklin	113,797	113,992	114,206	114,335	114,499	114,664	114,826	114,989	115,151	115,308	115,466
Hamilton	74,343	74,464	74,571	74,636	74,717	74,798	74,874	74,947	75,018	75,089	75,159
Lake	18,702	18,724	18,763	18,789	18,817	18,844	18,871	18,898	18,925	18,952	18,978
Lorain	22,390	22,425	22,463	22,477	22,507	22,536	22,565	22,594	22,620	22,647	22,673
Lucas	36,155	36,254	36,319	36,357	36,433	36,508	36,584	36,660	36,732	36,807	36,880
Mahoning	19,672	19,699	19,726	19,751	19,770	19,788	19,806	19,823	19,840	19,856	19,871
Medina	13,678	13,728	13,783	13,799	13,828	13,859	13,888	13,917	13,946	13,977	14,006
Miami	10,090	10,102	10,112	10,116	10,122	10,128	10,133	10,139	10,144	10,149	10,154
Summit	41,065	41,191	41,315	41,378	41,460	41,540	41,619	41,699	41,776	41,853	41,929

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:		
	3/11	3/12	3/13	3/14	3/16	3/18	3/20
Athens	4,686	4,697	4,701	4,710	4,717 (943) [226] {113}	4,724 (945) [227] {113}	4,730 (946) [227] {114}
Cuyahoga	97,792	97,975	98,207	98,295	98,665 (19,733) [4,736] {2,368}	99,027 (19,805) [4,753] {2,377}	99,381 (19,876) [4,770] {2,385}
Franklin	113,797	113,992	114,206	114,335	114,664 (22,933) [5,504] {2,752}	114,989 (22,998) [5,519] {2,760}	115,308 (23,062) [5,535] {2,767}
Hamilton	74,343	74,464	74,571	74,636	74,798 (14,960) [3,590] {1,795}	74,947 (14,989) [3,597] {1,799}	75,089 (15,018) [3,604] {1,802}
Lake	18,702	18,724	18,763	18,789	18,844 (3,769) [905] {452}	18,898 (3,780) [907] {454}	18,952 (3,790) [910] {455}
Lorain	22,390	22,425	22,463	22,477	22,536 (4,507) [1,082] {541}	22,594 (4,519) [1,085] {542}	22,647 (4,529) [1,087] {544}
Lucas	36,155	36,254	36,319	36,357	36,508 (7,302) [1,752] {876}	36,660 (7,332) [1,760] {880}	36,807 (7,361) [1,767] {883}
Mahoning	19,672	19,699	19,726	19,751	19,788 (3,958) [950] {475}	19,823 (3,965) [952] {476}	19,856 (3,971) [953] {477}
Medina	13,678	13,728	13,783	13,799	13,859 (2,772) [665] {333}	13,917 (2,783) [668] {334}	13,977 (2,795) [671] {335}
Miami	10,090	10,102	10,112	10,116	10,128 (2,026) [486] {243}	10,139 (2,028) [487] {243}	10,149 (2,030) [487] {244}
Summit	41,065	41,191	41,315	41,378	41,540 (8,308) [1,994] {997}	41,699 (8,340) [2,002] {1,001}	41,853 (8,371) [2,009] {1,004}

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.