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

Date: 12/23/20

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 12/23/20 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.

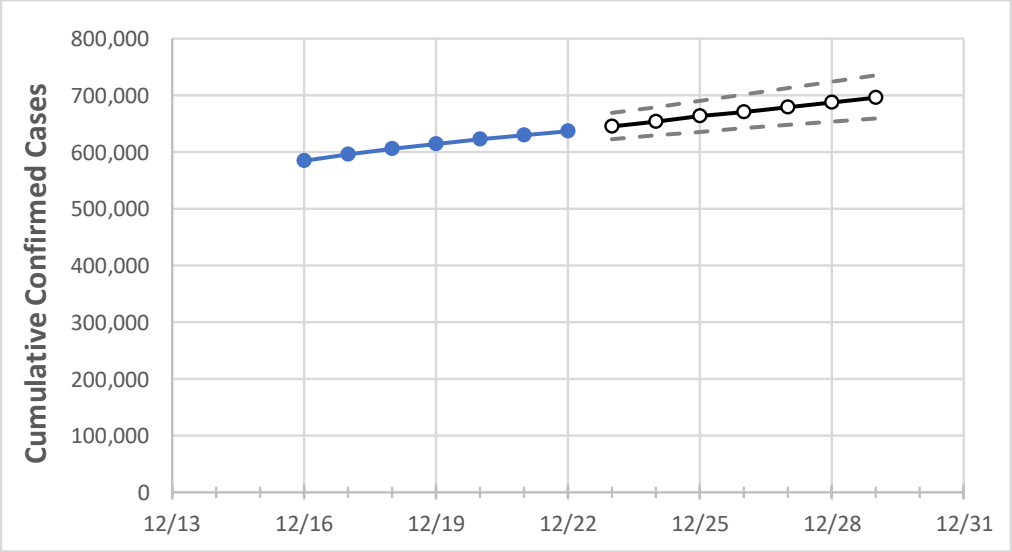
IEM's Modeling Lead

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:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Ohio	614,429	622,806	629,354	637,032	645,647	654,341	662,907	671,232	679,453	687,702	695,864

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 20%, and are often within 10%, of actual confirmed cases.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Athens	2,797	2,826	2,841	2,863	2,888	2,912	2,936	2,960	2,983	3,005	3,026
Cuyahoga	61,201	62,366	63,047	63,720	64,640	65,526	66,396	67,268	68,166	69,027	69,889
Franklin	74,477	75,316	76,188	77,087	78,009	78,943	79,867	80,772	81,685	82,588	83,486
Hamilton	46,283	46,842	47,264	47,713	48,344	48,960	49,569	50,192	50,797	51,428	52,059
Lake	11,034	11,200	11,314	11,501	11,647	11,790	11,934	12,074	12,216	12,353	12,493
Lorain	12,672	12,905	13,045	13,215	13,419	13,618	13,817	14,012	14,206	14,400	14,592
Lucas	22,989	23,166	23,405	23,571	23,860	24,139	24,411	24,675	24,936	25,203	25,462
Mahoning	12,795	12,999	13,122	13,345	13,525	13,701	13,873	14,042	14,209	14,374	14,536
Medina	8,104	8,218	8,296	8,426	8,562	8,701	8,837	8,970	9,104	9,243	9,375
Miami	6,703	6,787	6,847	6,941	7,023	7,100	7,178	7,255	7,331	7,407	7,480
Summit	24,258	24,560	24,859	25,305	25,697	26,096	26,478	26,865	27,250	27,629	28,010

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:		
	12/19	12/20	12/21	12/22	12/24	12/26	12/28
Athens	2,797	2,826	2,841	2,863	2,912 (582) [140] {70}	2,960 (592) [142] {71}	3,005 (601) [144] {72}
Cuyahoga	61,201	62,366	63,047	63,720	65,526 (13,105) [3,145] {1,573}	67,268 (13,454) [3,229] {1,614}	69,027 (13,805) [3,313] {1,657
Franklin	74,477	75,316	76,188	77,087	78,943 (15,789) [3,789] {1,895}	80,772 (16,154) [3,877] {1,939}	82,588 (16,518) [3,964] {1,982
Hamilton	46,283	46,842	47,264	47,713	48,960 (9,792) [2,350] {1,175}	50,192 (10,038) [2,409] {1,205}	51,428 (10,286) [2,469] {1,234
Lake	11,034	11,200	11,314	11,501	11,790 (2,358) [566] {283}	12,074 (2,415) [580] {290}	12,353 (2,471) [593] {296}
Lorain	12,672	12,905	13,045	13,215	13,618 (2,724) [654] {327}	14,012 (2,802) [673] {336}	14,400 (2,880) [691] {346}
Lucas	22,989	23,166	23,405	23,571	24,139 (4,828) [1,159] {579}	24,675 (4,935) [1,184] {592}	25,203 (5,041) [1,210] {605}
Mahoning	12,795	12,999	13,122	13,345	13,701 (2,740) [658] {329}	14,042 (2,808) [674] {337}	14,374 (2,875) [690] {345}
Medina	8,104	8,218	8,296	8,426	8,701 (1,740) [418] {209}	8,970 (1,794) [431] {215}	9,243 (1,849) [444] {222}
Miami	6,703	6,787	6,847	6,941	7,100 (1,420) [341] {170}	7,255 (1,451) [348] {174}	7,407 (1,481) [356] {178}
Summit	24,258	24,560	24,859	25,305	26,096 (5,219) [1,253] {626}	26,865 (5,373) [1,290] {645}	27,629 (5,526) [1,326] {663}

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.