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

Date: 3/11/21

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 3/11/21 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.

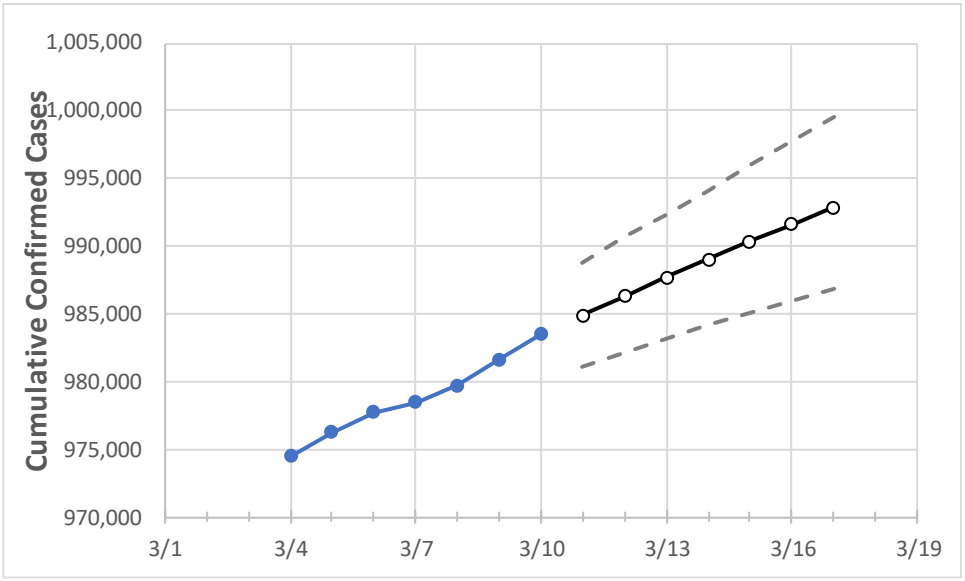
IEM's Modeling Lead

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Ohio	978,471	979,725	981,618	983,486	984,895	986,296	987,687	989,005	990,344	991,610	992,858

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Athens	4,664	4,671	4,678	4,682	4,686	4,690	4,693	4,696	4,699	4,703	4,705
Cuyahoga	96,933	97,121	97,369	97,639	97,852	98,071	98,290	98,508	98,723	98,938	99,150
Franklin	113,037	113,218	113,458	113,640	113,811	113,983	114,151	114,318	114,484	114,652	114,813
Hamilton	73,923	73,990	74,112	74,226	74,311	74,391	74,470	74,544	74,615	74,685	74,751
Lake	18,564	18,602	18,635	18,673	18,701	18,729	18,756	18,783	18,809	18,835	18,858
Lorain	22,218	22,242	22,314	22,358	22,392	22,425	22,457	22,489	22,521	22,551	22,581
Lucas	35,802	35,853	35,943	36,060	36,146	36,228	36,312	36,393	36,476	36,559	36,640
Mahoning	19,586	19,611	19,632	19,652	19,671	19,689	19,706	19,724	19,739	19,754	19,768
Medina	13,531	13,559	13,604	13,662	13,694	13,727	13,759	13,792	13,824	13,856	13,889
Miami	10,065	10,068	10,077	10,083	10,090	10,096	10,102	10,108	10,113	10,119	10,124
Summit	40,720	40,800	40,879	40,985	41,064	41,142	41,216	41,291	41,362	41,433	41,503

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:		
	3/7	3/8	3/9	3/10	3/12	3/14	3/16
Athens	4,664	4,671	4,678	4,682	4,690 (938) [225] {113}	4,696 (939) [225] {113}	4,703 (941) [226] {113}
Cuyahoga	96,933	97,121	97,369	97,639	98,071 (19,614) [4,707] {2,354}	98,508 (19,702) [4,728] {2,364}	98,938 (19,788) [4,749] {2,375}
Franklin	113,037	113,218	113,458	113,640	113,983 (22,797) [5,471] {2,736}	114,318 (22,864) [5,487] {2,744}	114,652 (22,930) [5,503] {2,752}
Hamilton	73,923	73,990	74,112	74,226	74,391 (14,878) [3,571] {1,785}	74,544 (14,909) [3,578] {1,789}	74,685 (14,937) [3,585] {1,792}
Lake	18,564	18,602	18,635	18,673	18,729 (3,746) [899] {449}	18,783 (3,757) [902] {451}	18,835 (3,767) [904] {452}
Lorain	22,218	22,242	22,314	22,358	22,425 (4,485) [1,076] {538}	22,489 (4,498) [1,079] {540}	22,551 (4,510) [1,082] {541}
Lucas	35,802	35,853	35,943	36,060	36,228 (7,246) [1,739] {869}	36,393 (7,279) [1,747] {873}	36,559 (7,312) [1,755] {877}
Mahoning	19,586	19,611	19,632	19,652	19,689 (3,938) [945] {473}	19,724 (3,945) [947] {473}	19,754 (3,951) [948] {474}
Medina	13,531	13,559	13,604	13,662	13,727 (2,745) [659] {329}	13,792 (2,758) [662] {331}	13,856 (2,771) [665] {333}
Miami	10,065	10,068	10,077	10,083	10,096 (2,019) [485] {242}	10,108 (2,022) [485] {243}	10,119 (2,024) [486] {243}
Summit	40,720	40,800	40,879	40,985	41,142 (8,228) [1,975] {987}	41,291 (8,258) [1,982] {991}	41,433 (8,287) [1,989] {994}

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.