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

Date: 3/2/22

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 3/2/22 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.

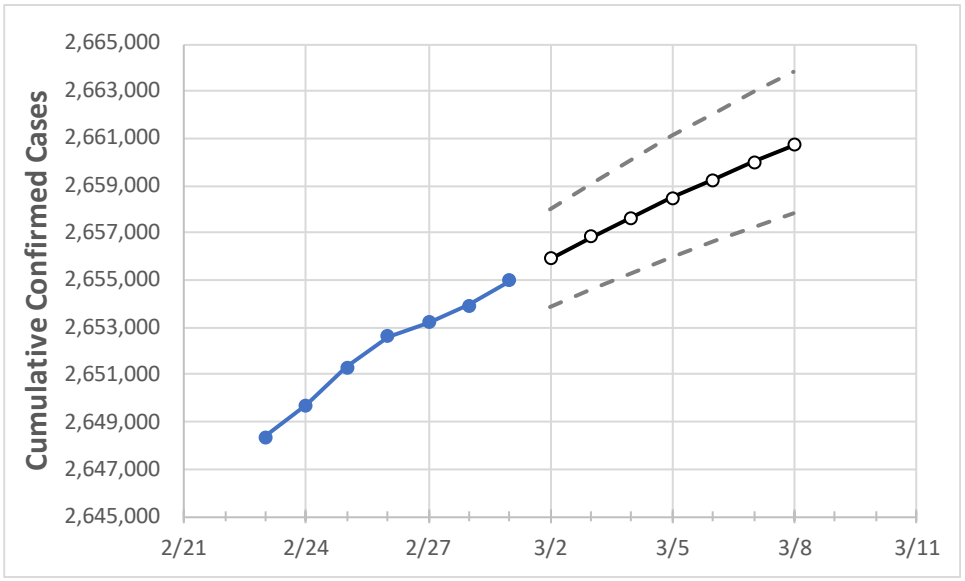
IEM's Modeling Lead

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Ohio	2,652,634	2,653,211	2,653,940	2,654,991	2,655,932	2,656,832	2,657,665	2,658,476	2,659,266	2,660,023	2,660,715

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Athens	14,276	14,285	14,290	14,304	14,318	14,330	14,343	14,354	14,365	14,376	14,386
Cuyahoga	266,338	266,391	266,439	266,522	266,593	266,665	266,734	266,801	266,868	266,931	266,995
Franklin	286,088	286,146	286,251	286,332	286,431	286,527	286,617	286,702	286,786	286,868	286,942
Hamilton	185,765	185,804	185,836	185,879	185,940	185,994	186,047	186,099	186,143	186,194	186,238
Lake	48,550	48,554	48,565	48,573	48,584	48,596	48,606	48,616	48,627	48,637	48,646
Lorain	66,122	66,143	66,152	66,160	66,177	66,192	66,207	66,221	66,236	66,249	66,262
Lucas	98,695	98,707	98,737	98,796	98,842	98,887	98,931	98,972	99,009	99,049	99,085
Mahoning	53,041	53,053	53,065	53,076	53,088	53,101	53,112	53,123	53,133	53,143	53,153
Medina	39,744	39,755	39,769	39,780	39,790	39,799	39,808	39,817	39,826	39,834	39,843
Miami	25,603	25,613	25,616	25,620	25,627	25,633	25,639	25,644	25,649	25,654	25,659
Summit	111,555	111,577	111,601	111,623	111,646	111,666	111,687	111,707	111,726	111,746	111,763

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Athens	14,276	14,285	14,290	14,304	14,330 (2,866) [688] {344}	14,354 (2,871) [689] {344}	14,376 (2,875) [690] {345}
Cuyahoga	266,338	266,391	266,439	266,522	266,665 (53,333) [12,800] {6,400}	266,801 (53,360) [12,806] {6,403}	266,931 (53,386) [12,813] {6,406}
Franklin	286,088	286,146	286,251	286,332	286,527 (57,305) [13,753] {6,877}	286,702 (57,340) [13,762] {6,881}	286,868 (57,374) [13,770] {6,885}
Hamilton	185,765	185,804	185,836	185,879	185,994 (37,199) [8,928] {4,464}	186,099 (37,220) [8,933] {4,466}	186,194 (37,239) [8,937] {4,469}
Lake	48,550	48,554	48,565	48,573	48,596 (9,719) [2,333] {1,166}	48,616 (9,723) [2,334] {1,167}	48,637 (9,727) [2,335] {1,167}
Lorain	66,122	66,143	66,152	66,160	66,192 (13,238) [3,177] {1,589}	66,221 (13,244) [3,179] {1,589}	66,249 (13,250) [3,180] {1,590}
Lucas	98,695	98,707	98,737	98,796	98,887 (19,777) [4,747] {2,373}	98,972 (19,794) [4,751] {2,375}	99,049 (19,810) [4,754] {2,377}
Mahoning	53,041	53,053	53,065	53,076	53,101 (10,620) [2,549] {1,274}	53,123 (10,625) [2,550] {1,275}	53,143 (10,629) [2,551] {1,275}
Medina	39,744	39,755	39,769	39,780	39,799 (7,960) [1,910] {955}	39,817 (7,963) [1,911] {956}	39,834 (7,967) [1,912] {956}
Miami	25,603	25,613	25,616	25,620	25,633 (5,127) [1,230] {615}	25,644 (5,129) [1,231] {615}	25,654 (5,131) [1,231] {616}
Summit	111,555	111,577	111,601	111,623	111,666 (22,333) [5,360] {2,680}	111,707 (22,341) [5,362] {2,681}	111,746 (22,349) [5,364] {2,682}

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.