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

Date: 2/23/22

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 2/23/22 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.

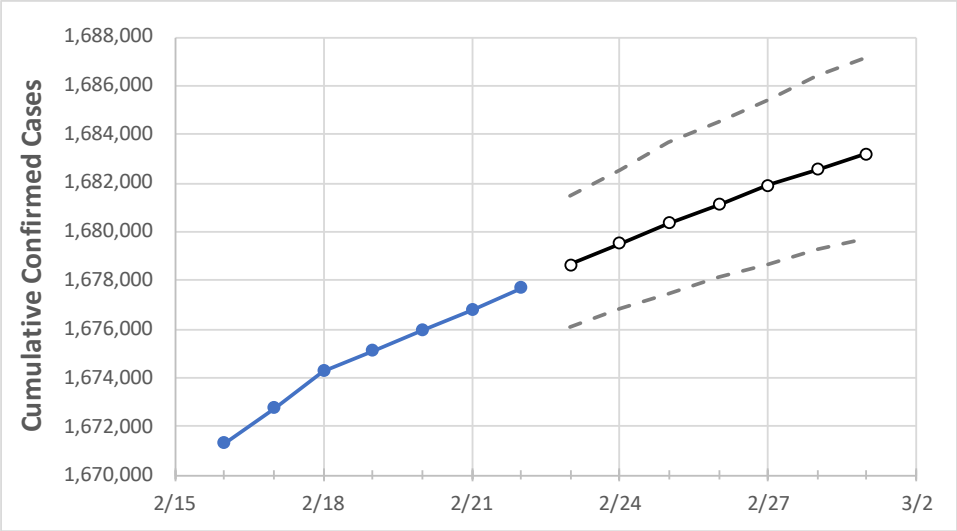
IEM's Modeling Lead

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.

Indiana State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Indiana	1,675,112	1,675,954	1,676,797	1,677,710	1,678,654	1,679,527	1,680,339	1,681,132	1,681,895	1,682,565	1,683,195

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.

Indiana Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Decatur	6,946	6,950	6,954	6,958	6,963	6,969	6,974	6,978	6,983	6,987	6,991
Hamilton	80,779	80,904	81,029	81,049	81,105	81,161	81,216	81,267	81,318	81,370	81,415
Hendricks	40,375	40,394	40,414	40,431	40,452	40,472	40,490	40,507	40,525	40,540	40,555
Johnson	41,967	41,982	41,998	42,012	42,031	42,050	42,067	42,083	42,099	42,114	42,127
Lake	105,108	105,144	105,180	105,214	105,245	105,275	105,304	105,332	105,356	105,380	105,404
Madison	32,356	32,372	32,387	32,399	32,420	32,437	32,456	32,473	32,489	32,505	32,519
Marion	222,589	222,680	222,772	222,846	222,926	223,003	223,072	223,139	223,201	223,265	223,316
St. Joseph	69,944	69,969	69,993	70,011	70,038	70,066	70,090	70,115	70,136	70,156	70,177

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.*

Indiana Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Decatur	6,946	6,950	6,954	6,958	6,969 (1,394) [334] {167}	6,978 (1,396) [335] {167}	6,987 (1,397) [335] {168}
Hamilton	80,779	80,904	81,029	81,049	81,161 (16,232) [3,896] {1,948}	81,267 (16,253) [3,901] {1,950}	81,370 (16,274) [3,906] {1,953}
Hendricks	40,375	40,394	40,414	40,431	40,472 (8,094) [1,943] {971}	40,507 (8,101) [1,944] {972}	40,540 (8,108) [1,946] {973}
Johnson	41,967	41,982	41,998	42,012	42,050 (8,410) [2,018] {1,009}	42,083 (8,417) [2,020] {1,010}	42,114 (8,423) [2,021] {1,011}
Lake	105,108	105,144	105,180	105,214	105,275 (21,055) [5,053] {2,527}	105,332 (21,066) [5,056] {2,528}	105,380 (21,076) [5,058] {2,529}
Madison	32,356	32,372	32,387	32,399	32,437 (6,487) [1,557] {778}	32,473 (6,495) [1,559] {779}	32,505 (6,501) [1,560] {780}
Marion	222,589	222,680	222,772	222,846	223,003 (44,601) [10,704] {5,352}	223,139 (44,628) [10,711] {5,355}	223,265 (44,653) [10,717] {5,358}
St. Joseph	69,944	69,969	69,993	70,011	70,066 (14,013) [3,363] {1,682}	70,115 (14,023) [3,366] {1,683}	70,156 (14,031) [3,368] {1,684}

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.