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

Date: 9/29/21

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 9/29/21 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.

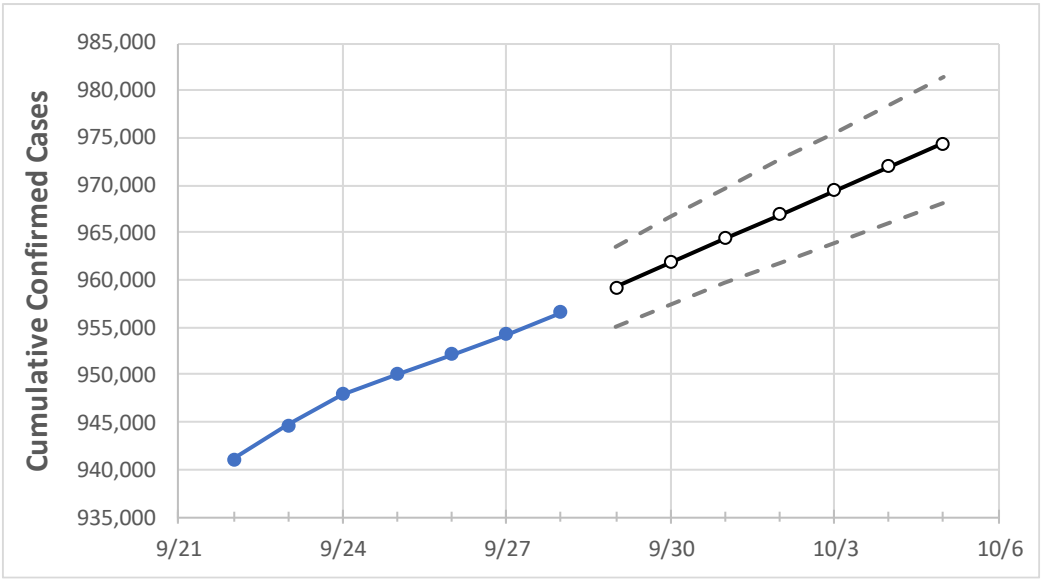
IEM's Modeling Lead

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.

Indiana State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Indiana	950,022	952,126	954,230	956,548	959,210	961,855	964,378	966,935	969,453	971,946	974,399

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Decatur	3,895	3,904	3,912	3,918	3,928	3,938	3,947	3,957	3,966	3,974	3,983
Hamilton	44,163	44,245	44,326	44,417	44,515	44,611	44,704	44,796	44,887	44,978	45,067
Hendricks	22,465	22,521	22,576	22,622	22,686	22,748	22,805	22,868	22,925	22,983	23,042
Johnson	23,772	23,817	23,862	23,935	23,990	24,044	24,097	24,147	24,198	24,248	24,296
Lake	63,674	63,776	63,878	64,009	64,128	64,248	64,364	64,480	64,598	64,716	64,832
Madison	17,537	17,583	17,628	17,667	17,720	17,775	17,826	17,877	17,929	17,980	18,029
Marion	129,375	129,633	129,890	130,170	130,515	130,873	131,203	131,533	131,869	132,198	132,530
St. Joseph	42,204	42,286	42,368	42,445	42,541	42,632	42,722	42,812	42,904	42,995	43,081

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:		
	9/25	9/26	9/27	9/28	9/30	10/2	10/4
Decatur	3,895	3,904	3,912	3,918	3,938 (788) [189] {95}	3,957 (791) [190] {95}	3,974 (795) [191] {95}
Hamilton	44,163	44,245	44,326	44,417	44,611 (8,922) [2,141] {1,071}	44,796 (8,959) [2,150] {1,075}	44,978 (8,996) [2,159] {1,079}
Hendricks	22,465	22,521	22,576	22,622	22,748 (4,550) [1,092] {546}	22,868 (4,574) [1,098] {549}	22,983 (4,597) [1,103] {552}
Johnson	23,772	23,817	23,862	23,935	24,044 (4,809) [1,154] {577}	24,147 (4,829) [1,159] {580}	24,248 (4,850) [1,164] {582}
Lake	63,674	63,776	63,878	64,009	64,248 (12,850) [3,084] {1,542}	64,480 (12,896) [3,095] {1,548}	64,716 (12,943) [3,106] {1,553}
Madison	17,537	17,583	17,628	17,667	17,775 (3,555) [853] {427}	17,877 (3,575) [858] {429}	17,980 (3,596) [863] {432}
Marion	129,375	129,633	129,890	130,170	130,873 (26,175) [6,282] {3,141}	131,533 (26,307) [6,314] {3,157}	132,198 (26,440) [6,346] {3,173}
St. Joseph	42,204	42,286	42,368	42,445	42,632 (8,526) [2,046] {1,023}	42,812 (8,562) [2,055] {1,027}	42,995 (8,599) [2,064] {1,032}

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.