IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/17/21

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 <u>not</u> 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 9/17/21 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
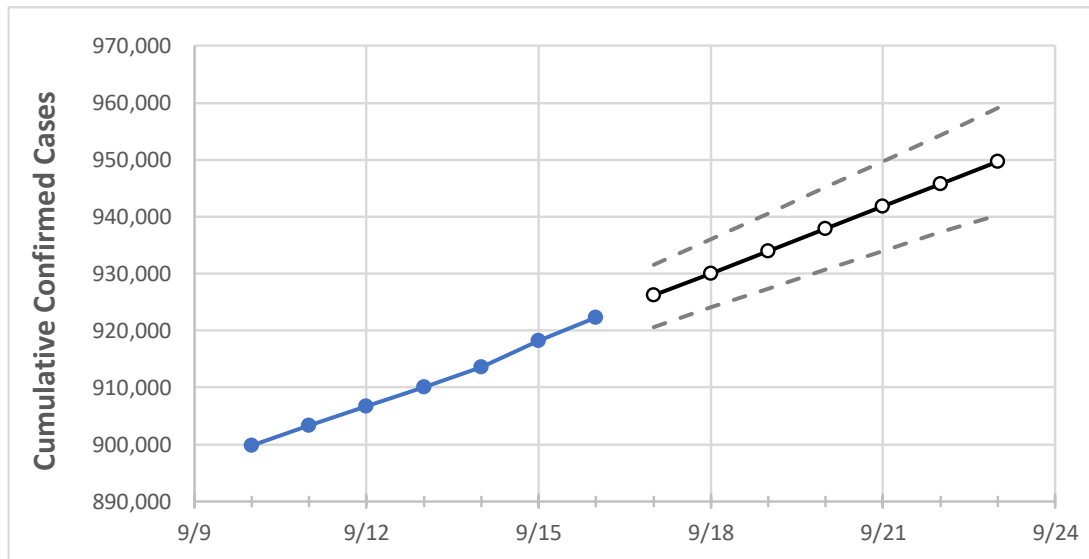
	Actual Confirmed Cases On:			Projected Cases For:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
Indiana	910,013	913,528	918,230	922,320	926,145	930,071	933,951	937,915	941,765	945,690	949,618

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:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
Decatur	3,727	3,738	3,768	3,778	3,799	3,817	3,837	3,857	3,878	3,896	3,917
Hamilton	42,701	42,834	43,009	43,160	43,308	43,458	43,604	43,756	43,906	44,061	44,213
Hendricks	21,505	21,624	21,708	21,821	21,920	22,025	22,124	22,229	22,330	22,434	22,539
Johnson	22,896	23,002	23,106	23,192	23,279	23,362	23,447	23,527	23,612	23,690	23,772
Lake	62,033	62,168	62,337	62,499	62,655	62,813	62,972	63,133	63,291	63,454	63,615
Madison	16,724	16,810	16,899	16,978	17,055	17,133	17,211	17,290	17,366	17,443	17,520
Marion	124,200	124,632	125,249	125,741	126,259	126,764	127,274	127,796	128,318	128,840	129,354
St. Joseph	40,912	41,021	41,155	41,310	41,427	41,548	41,665	41,789	41,910	42,033	42,157

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:		
	9/13	9/14	9/15	9/16	9/18	9/20	9/22
Decatur	3,727	3,738	3,768	3,778	3,817 (763) [183] {92}	3,857 (771) [185] {93}	3,896 (779) [187] {94}
Hamilton	42,701	42,834	43,009	43,160	43,458 (8,692) [2,086] {1,043}	43,756 (8,751) [2,100] {1,050}	44,061 (8,812) [2,115] {1,057}
Hendricks	21,505	21,624	21,708	21,821	22,025 (4,405) [1,057] {529}	22,229 (4,446) [1,067] {533}	22,434 (4,487) [1,077] {538}
Johnson	22,896	23,002	23,106	23,192	23,362 (4,672) [1,121] {561}	23,527 (4,705) [1,129] {565}	23,690 (4,738) [1,137] {569}
Lake	62,033	62,168	62,337	62,499	62,813 (12,563) [3,015] {1,508}	63,133 (12,627) [3,030] {1,515}	63,454 (12,691) [3,046] {1,523}
Madison	16,724	16,810	16,899	16,978	17,133 (3,427) [822] {411}	17,290 (3,458) [830] {415}	17,443 (3,489) [837] {419}
Marion	124,200	124,632	125,249	125,741	126,764 (25,353) [6,085] {3,042}	127,796 (25,559) [6,134] {3,067}	128,840 (25,768) [6,184] {3,092}
St. Joseph	40,912	41,021	41,155	41,310	41,548 (8,310) [1,994] {997}	41,789 (8,358) [2,006] {1,003}	42,033 (8,407) [2,018] {1,009}

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.