IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/10/22

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 <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 1/10/22 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
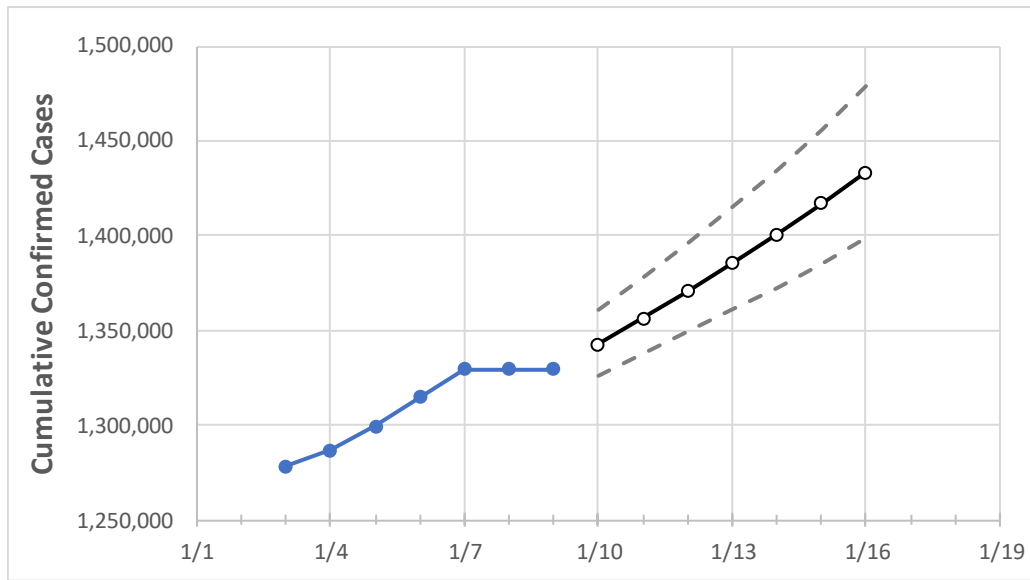
	Actual Confirmed Cases On:				Projected Cases For:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Indiana	1,314,688	1,329,423	1,329,423	1,329,423	1,342,604	1,356,175	1,370,599	1,385,328	1,400,742	1,417,025	1,433,416

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Decatur	5,313	5,352	5,352	5,352	5,378	5,405	5,433	5,460	5,489	5,520	5,549
Hamilton	62,396	63,134	63,134	63,134	63,997	64,899	65,815	66,790	67,823	68,886	70,010
Hendricks	30,873	31,308	31,308	31,308	31,653	32,008	32,378	32,764	33,172	33,600	34,039
Johnson	32,719	33,084	33,084	33,084	33,444	33,809	34,196	34,600	35,010	35,449	35,883
Lake	91,127	92,302	92,302	92,302	93,637	95,018	96,438	97,918	99,438	101,045	102,680
Madison	25,139	25,500	25,500	25,500	25,745	26,005	26,274	26,551	26,836	27,137	27,433
Marion	176,376	179,158	179,158	179,158	182,011	185,004	188,116	191,439	194,930	198,590	202,468
St. Joseph	58,058	58,574	58,574	58,574	59,043	59,525	60,029	60,550	61,089	61,641	62,218

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:		
	1/6	1/7	1/8	1/9	1/11	1/13	1/15
Decatur	5,313	5,352	5,352	5,352	5,405 (1,081) [259] {130}	5,460 (1,092) [262] {131}	5,520 (1,104) [265] {132}
Hamilton	62,396	63,134	63,134	63,134	64,899 (12,980) [3,115] {1,558}	66,790 (13,358) [3,206] {1,603}	68,886 (13,777) [3,307] {1,653}
Hendricks	30,873	31,308	31,308	31,308	32,008 (6,402) [1,536] {768}	32,764 (6,553) [1,573] {786}	33,600 (6,720) [1,613] {806}
Johnson	32,719	33,084	33,084	33,084	33,809 (6,762) [1,623] {811}	34,600 (6,920) [1,661] {830}	35,449 (7,090) [1,702] {851}
Lake	91,127	92,302	92,302	92,302	95,018 (19,004) [4,561] {2,280}	97,918 (19,584) [4,700] {2,350}	101,045 (20,209) [4,850] {2,425}
Madison	25,139	25,500	25,500	25,500	26,005 (5,201) [1,248] {624}	26,551 (5,310) [1,274] {637}	27,137 (5,427) [1,303] {651}
Marion	176,376	179,158	179,158	179,158	185,004 (37,001) [8,880] {4,440}	191,439 (38,288) [9,189] {4,595}	198,590 (39,718) [9,532] {4,766}
St. Joseph	58,058	58,574	58,574	58,574	59,525 (11,905) [2,857] {1,429}	60,550 (12,110) [2,906] {1,453}	61,641 (12,328) [2,959] {1,479}

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.