IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/22/21

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 6/22/21 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
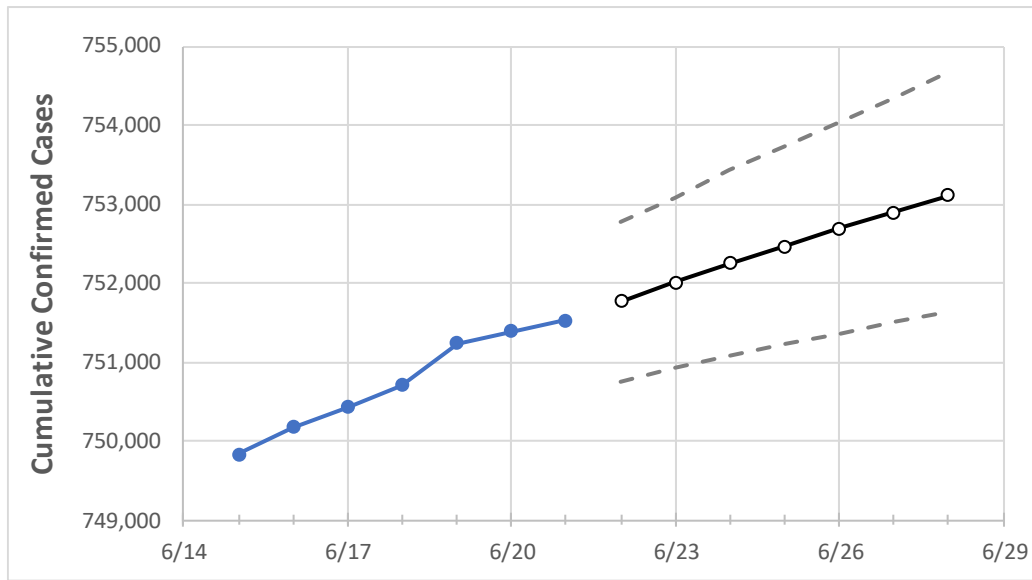
	Actual Confirmed Cases On:			Projected Cases For:						
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28
Indiana	750,702	751,242	751,384	751,526	751,773	752,011	752,245	752,467	752,691	752,900	753,114

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:						
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28
Decatur	2,898	2,898	2,898	2,898	2,900	2,902	2,904	2,906	2,909	2,911	2,914
Hamilton	36,570	36,588	36,596	36,604	36,615	36,626	36,636	36,646	36,656	36,665	36,675
Hendricks	17,615	17,682	17,686	17,689	17,694	17,699	17,703	17,707	17,712	17,716	17,720
Johnson	18,452	18,471	18,474	18,477	18,486	18,495	18,504	18,513	18,522	18,531	18,541
Lake	55,680	55,691	55,703	55,715	55,748	55,783	55,817	55,850	55,883	55,917	55,950
Madison	13,141	13,149	13,154	13,158	13,162	13,166	13,169	13,172	13,176	13,179	13,182
Marion	103,237	103,293	103,311	103,328	103,363	103,396	103,429	103,460	103,491	103,520	103,549
St. Joseph	36,983	36,990	36,994	36,998	37,004	37,009	37,015	37,020	37,024	37,028	37,033

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:		
	6/18	6/19	6/20	6/21	6/23	6/25	6/27
Decatur	2,898	2,898	2,898	2,898	2,902 (580) [139] {70}	2,906 (581) [139] {70}	2,911 (582) [140] {70}
Hamilton	36,570	36,588	36,596	36,604	36,626 (7,325) [1,758] {879}	36,646 (7,329) [1,759] {880}	36,665 (7,333) [1,760] {880}
Hendricks	17,615	17,682	17,686	17,689	17,699 (3,540) [850] {425}	17,707 (3,541) [850] {425}	17,716 (3,543) [850] {425}
Johnson	18,452	18,471	18,474	18,477	18,495 (3,699) [888] {444}	18,513 (3,703) [889] {444}	18,531 (3,706) [890] {445}
Lake	55,680	55,691	55,703	55,715	55,783 (11,157) [2,678] {1,339}	55,850 (11,170) [2,681] {1,340}	55,917 (11,183) [2,684] {1,342}
Madison	13,141	13,149	13,154	13,158	13,166 (2,633) [632] {316}	13,172 (2,634) [632] {316}	13,179 (2,636) [633] {316}
Marion	103,237	103,293	103,311	103,328	103,396 (20,679) [4,963] {2,482}	103,460 (20,692) [4,966] {2,483}	103,520 (20,704) [4,969] {2,484}
St. Joseph	36,983	36,990	36,994	36,998	37,009 (7,402) [1,776] {888}	37,020 (7,404) [1,777] {888}	37,028 (7,406) [1,777] {889}

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.