IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/29/21

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 <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 6/29/21 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.

Maryland State Projections
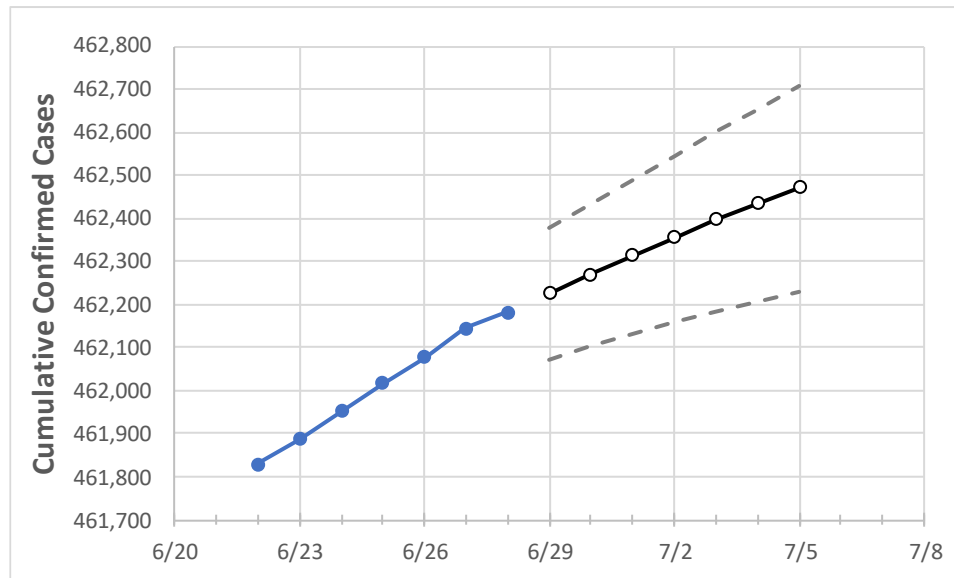
	Actual Confirmed Cases On:				Projected Cases For:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Maryland	462,017	462,078	462,144	462,181	462,227	462,271	462,315	462,357	462,397	462,434	462,472

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.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Anne Arundel	43,956	43,958	43,963	43,966	43,970	43,974	43,977	43,981	43,985	43,988	43,991
Baltimore City	53,109	53,124	53,128	53,132	53,137	53,142	53,147	53,152	53,156	53,160	53,164
Baltimore County	65,928	65,927	65,935	65,939	65,946	65,953	65,959	65,965	65,971	65,976	65,982
Charles	10,961	10,962	10,963	10,963	10,964	10,965	10,966	10,967	10,968	10,969	10,970
Frederick	19,831	19,831	19,832	19,833	19,834	19,835	19,836	19,836	19,837	19,838	19,838
Harford	16,638	16,646	16,647	16,648	16,649	16,651	16,652	16,654	16,655	16,656	16,657
Howard	19,314	19,317	19,322	19,322	19,324	19,327	19,329	19,331	19,333	19,335	19,337
Montgomery	71,141	71,153	71,162	71,171	71,177	71,184	71,190	71,195	71,201	71,207	71,212
Prince George's	85,483	85,495	85,504	85,526	85,533	85,540	85,546	85,553	85,559	85,564	85,570

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.*

Maryland Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	6/25	6/26	6/27	6/28	6/30	7/2	7/4
Anne Arundel	43,956	43,958	43,963	43,966	43,974 (8,795) [2,111] {1,055}	43,981 (8,796) [2,111] {1,056}	43,988 (8,798) [2,111] {1,056}
Baltimore City	53,109	53,124	53,128	53,132	53,142 (10,628) [2,551] {1,275}	53,152 (10,630) [2,551] {1,276}	53,160 (10,632) [2,552] {1,276}
Baltimore County	65,928	65,927	65,935	65,939	65,953 (13,191) [3,166] {1,583}	65,965 (13,193) [3,166] {1,583}	65,976 (13,195) [3,167] {1,583}
Charles	10,961	10,962	10,963	10,963	10,965 (2,193) [526] {263}	10,967 (2,193) [526] {263}	10,969 (2,194) [527] {263}
Frederick	19,831	19,831	19,832	19,833	19,835 (3,967) [952] {476}	19,836 (3,967) [952] {476}	19,838 (3,968) [952] {476}
Harford	16,638	16,646	16,647	16,648	16,651 (3,330) [799] {400}	16,654 (3,331) [799] {400}	16,656 (3,331) [799] {400}
Howard	19,314	19,317	19,322	19,322	19,327 (3,865) [928] {464}	19,331 (3,866) [928] {464}	19,335 (3,867) [928] {464}
Montgomery	71,141	71,153	71,162	71,171	71,184 (14,237) [3,417] {1,708}	71,195 (14,239) [3,417] {1,709}	71,207 (14,241) [3,418] {1,709}
Prince George's	85,483	85,495	85,504	85,526	85,540 (17,108) [4,106] {2,053}	85,553 (17,111) [4,107] {2,053}	85,564 (17,113) [4,107] {2,054}

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.