IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/11/21

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 8/11/21 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
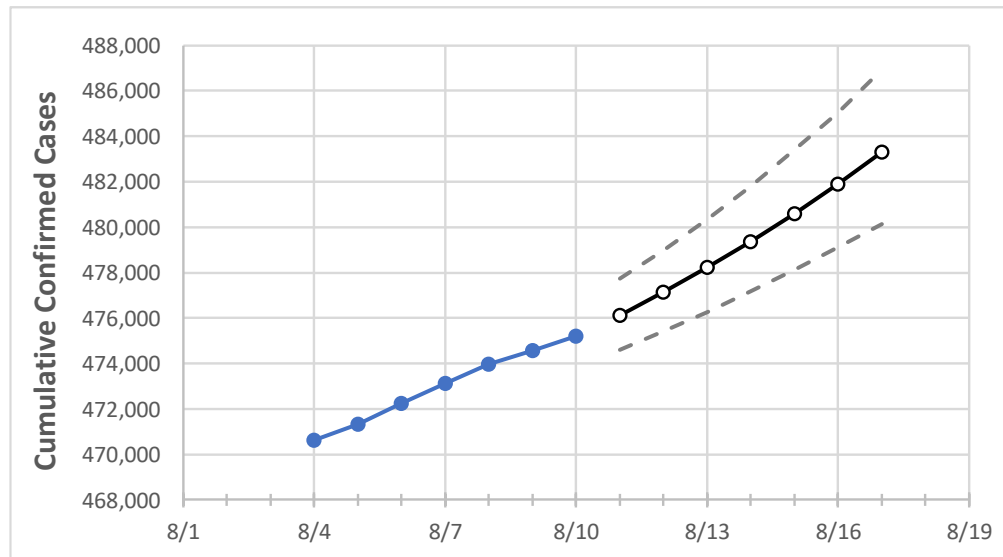
	Actual Confirmed Cases On:				Projected Cases For:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Maryland	473,116	473,969	474,555	475,184	476,122	477,138	478,216	479,369	480,597	481,892	483,312

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Anne Arundel	45,091	45,158	45,203	45,259	45,348	45,441	45,540	45,646	45,758	45,874	45,998
Baltimore City	54,103	54,172	54,235	54,282	54,368	54,463	54,564	54,671	54,785	54,909	55,041
Baltimore County	67,227	67,298	67,361	67,407	67,506	67,614	67,724	67,842	67,968	68,100	68,241
Charles	11,432	11,449	11,479	11,510	11,554	11,600	11,650	11,704	11,762	11,824	11,892
Frederick	20,355	20,383	20,423	20,458	20,509	20,563	20,622	20,683	20,751	20,823	20,901
Harford	17,078	17,106	17,122	17,152	17,188	17,225	17,266	17,308	17,353	17,401	17,451
Howard	19,755	19,803	19,820	19,829	19,857	19,887	19,918	19,952	19,987	20,023	20,061
Montgomery	72,971	73,058	73,178	73,308	73,453	73,611	73,775	73,952	74,142	74,342	74,552
Prince George's	87,852	87,978	88,102	88,268	88,461	88,667	88,889	89,123	89,375	89,640	89,923

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:		
	8/7	8/8	8/9	8/10	8/12	8/14	8/16
Anne Arundel	45,091	45,158	45,203	45,259	45,441 (9,088) [2,181] {1,091}	45,646 (9,129) [2,191] {1,096}	45,874 (9,175) [2,202] {1,101}
Baltimore City	54,103	54,172	54,235	54,282	54,463 (10,893) [2,614] {1,307}	54,671 (10,934) [2,624] {1,312}	54,909 (10,982) [2,636] {1,318}
Baltimore County	67,227	67,298	67,361	67,407	67,614 (13,523) [3,245] {1,623}	67,842 (13,568) [3,256] {1,628}	68,100 (13,620) [3,269] {1,634}
Charles	11,432	11,449	11,479	11,510	11,600 (2,320) [557] {278}	11,704 (2,341) [562] {281}	11,824 (2,365) [568] {284}
Frederick	20,355	20,383	20,423	20,458	20,563 (4,113) [987] {494}	20,683 (4,137) [993] {496}	20,823 (4,165) [999] {500}
Harford	17,078	17,106	17,122	17,152	17,225 (3,445) [827] {413}	17,308 (3,462) [831] {415}	17,401 (3,480) [835] {418}
Howard	19,755	19,803	19,820	19,829	19,887 (3,977) [955] {477}	19,952 (3,990) [958] {479}	20,023 (4,005) [961] {481}
Montgomery	72,971	73,058	73,178	73,308	73,611 (14,722) [3,533] {1,767}	73,952 (14,790) [3,550] {1,775}	74,342 (14,868) [3,568] {1,784}
Prince George's	87,852	87,978	88,102	88,268	88,667 (17,733) [4,256] {2,128}	89,123 (17,825) [4,278] {2,139}	89,640 (17,928) [4,303] {2,151}

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.