IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/18/21

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 8/18/21 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
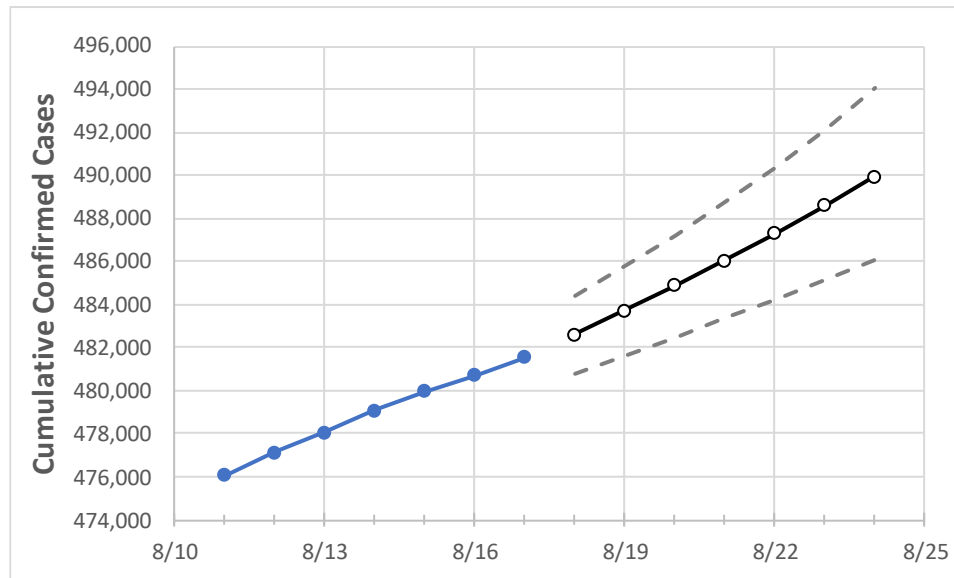
	Actual Confirmed Cases On:				Projected Cases For:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Maryland	479,083	479,952	480,718	481,569	482,639	483,734	484,881	486,075	487,326	488,619	489,952

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:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Anne Arundel	45,595	45,671	45,715	45,777	45,859	45,941	46,027	46,115	46,207	46,298	46,393
Baltimore City	54,641	54,726	54,787	54,849	54,940	55,035	55,135	55,237	55,344	55,455	55,569
Baltimore County	67,869	67,977	68,082	68,177	68,301	68,429	68,561	68,701	68,847	68,996	69,149
Charles	11,680	11,720	11,767	11,806	11,858	11,910	11,966	12,024	12,085	12,151	12,218
Frederick	20,625	20,665	20,743	20,800	20,859	20,921	20,987	21,056	21,127	21,202	21,280
Harford	17,291	17,320	17,357	17,390	17,428	17,467	17,507	17,549	17,592	17,636	17,681
Howard	19,952	19,988	20,015	20,047	20,083	20,121	20,160	20,201	20,245	20,290	20,337
Montgomery	73,761	73,842	73,960	74,070	74,202	74,337	74,473	74,614	74,759	74,907	75,060
Prince George's	88,991	89,131	89,275	89,467	89,663	89,867	90,074	90,292	90,511	90,738	90,973

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:		
	8/14	8/15	8/16	8/17	8/19	8/21	8/23
Anne Arundel	45,595	45,671	45,715	45,777	45,941 (9,188) [2,205] {1,103}	46,115 (9,223) [2,214] {1,107}	46,298 (9,260) [2,222] {1,111}
Baltimore City	54,641	54,726	54,787	54,849	55,035 (11,007) [2,642] {1,321}	55,237 (11,047) [2,651] {1,326}	55,455 (11,091) [2,662] {1,331}
Baltimore County	67,869	67,977	68,082	68,177	68,429 (13,686) [3,285] {1,642}	68,701 (13,740) [3,298] {1,649}	68,996 (13,799) [3,312] {1,656}
Charles	11,680	11,720	11,767	11,806	11,910 (2,382) [572] {286}	12,024 (2,405) [577] {289}	12,151 (2,430) [583] {292}
Frederick	20,625	20,665	20,743	20,800	20,921 (4,184) [1,004] {502}	21,056 (4,211) [1,011] {505}	21,202 (4,240) [1,018] {509}
Harford	17,291	17,320	17,357	17,390	17,467 (3,493) [838] {419}	17,549 (3,510) [842] {421}	17,636 (3,527) [847] {423}
Howard	19,952	19,988	20,015	20,047	20,121 (4,024) [966] {483}	20,201 (4,040) [970] {485}	20,290 (4,058) [974] {487}
Montgomery	73,761	73,842	73,960	74,070	74,337 (14,867) [3,568] {1,784}	74,614 (14,923) [3,581] {1,791}	74,907 (14,981) [3,596] {1,798}
Prince George's	88,991	89,131	89,275	89,467	89,867 (17,973) [4,314] {2,157}	90,292 (18,058) [4,334] {2,167}	90,738 (18,148) [4,355] {2,178}

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.