IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/15/21

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 10/15/21 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
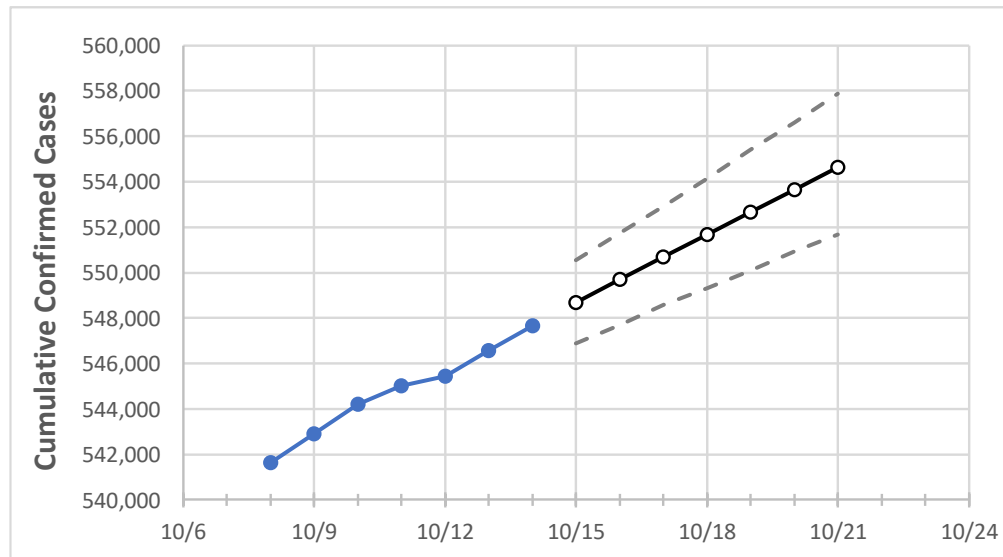
	Actual Confirmed Cases On:				Projected Cases For:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Maryland	545,028	545,439	546,552	547,675	548,677	549,696	550,698	551,680	552,664	553,665	554,634

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Anne Arundel	51,608	51,634	51,731	51,866	51,959	52,046	52,137	52,226	52,313	52,403	52,492
Baltimore City	60,287	60,340	60,457	60,496	60,592	60,687	60,778	60,871	60,961	61,055	61,145
Baltimore County	75,013	75,049	75,171	75,357	75,476	75,595	75,713	75,830	75,945	76,069	76,181
Charles	14,110	14,138	14,157	14,186	14,210	14,234	14,257	14,280	14,301	14,324	14,345
Frederick	23,557	23,601	23,647	23,693	23,734	23,774	23,815	23,858	23,897	23,938	23,979
Harford	19,938	19,967	20,042	20,090	20,147	20,205	20,264	20,322	20,383	20,445	20,507
Howard	22,249	22,260	22,299	22,339	22,367	22,396	22,425	22,454	22,482	22,510	22,536
Montgomery	81,028	81,142	81,245	81,338	81,428	81,520	81,610	81,703	81,790	81,880	81,965
Prince George's	98,237	98,360	98,455	98,569	98,688	98,806	98,926	99,043	99,158	99,284	99,392

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:		
	10/11	10/12	10/13	10/14	10/16	10/18	10/20
Anne Arundel	51,608	51,634	51,731	51,866	52,046 (10,409) [2,498] {1,249}	52,226 (10,445) [2,507] {1,253}	52,403 (10,481) [2,515] {1,258}
Baltimore City	60,287	60,340	60,457	60,496	60,687 (12,137) [2,913] {1,456}	60,871 (12,174) [2,922] {1,461}	61,055 (12,211) [2,931] {1,465}
Baltimore County	75,013	75,049	75,171	75,357	75,595 (15,119) [3,629] {1,814}	75,830 (15,166) [3,640] {1,820}	76,069 (15,214) [3,651] {1,826}
Charles	14,110	14,138	14,157	14,186	14,234 (2,847) [683] {342}	14,280 (2,856) [685] {343}	14,324 (2,865) [688] {344}
Frederick	23,557	23,601	23,647	23,693	23,774 (4,755) [1,141] {571}	23,858 (4,772) [1,145] {573}	23,938 (4,788) [1,149] {575}
Harford	19,938	19,967	20,042	20,090	20,205 (4,041) [970] {485}	20,322 (4,064) [975] {488}	20,445 (4,089) [981] {491}
Howard	22,249	22,260	22,299	22,339	22,396 (4,479) [1,075] {538}	22,454 (4,491) [1,078] {539}	22,510 (4,502) [1,080] {540}
Montgomery	81,028	81,142	81,245	81,338	81,520 (16,304) [3,913] {1,956}	81,703 (16,341) [3,922] {1,961}	81,880 (16,376) [3,930] {1,965}
Prince George's	98,237	98,360	98,455	98,569	98,806 (19,761) [4,743] {2,371}	99,043 (19,809) [4,754] {2,377}	99,284 (19,857) [4,766] {2,383}

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.