IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/14/21

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 not 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 5/14/21 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
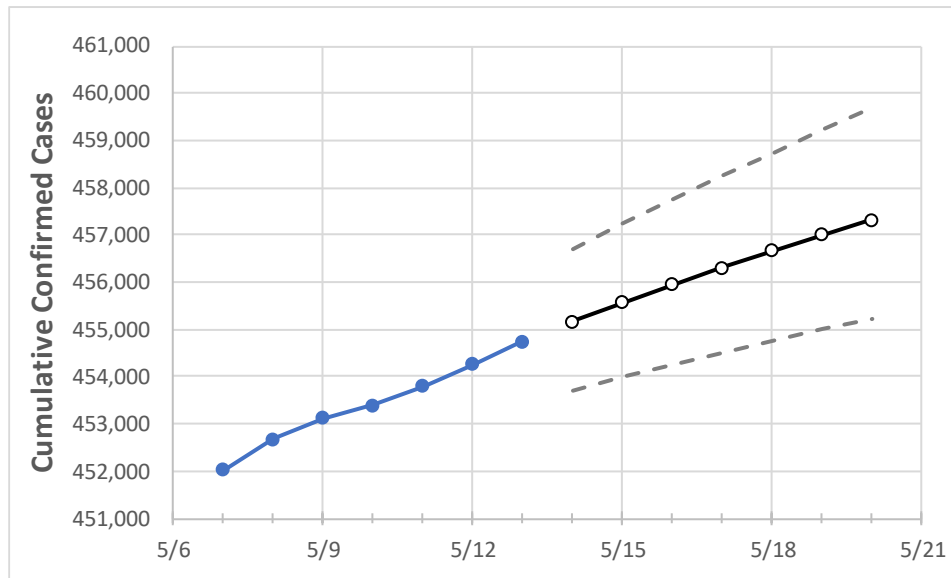
	Actual Confirmed Cases On:				Projected Cases For:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Maryland	453,401	453,800	454,271	454,745	455,166	455,563	455,949	456,310	456,660	456,996	457,326

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Anne Arundel	43,148	43,197	43,248	43,301	43,349	43,394	43,439	43,480	43,522	43,563	43,600
Baltimore City	51,969	52,015	52,099	52,153	52,218	52,281	52,340	52,397	52,454	52,504	52,554
Baltimore County	64,579	64,636	64,724	64,807	64,881	64,950	65,014	65,076	65,133	65,188	65,242
Charles	10,677	10,685	10,698	10,713	10,723	10,733	10,742	10,751	10,759	10,768	10,776
Frederick	19,590	19,604	19,614	19,631	19,641	19,650	19,659	19,667	19,675	19,683	19,690
Harford	16,292	16,316	16,328	16,349	16,363	16,377	16,391	16,403	16,415	16,427	16,437
Howard	19,033	19,036	19,053	19,067	19,078	19,088	19,098	19,107	19,115	19,123	19,130
Montgomery	70,298	70,353	70,394	70,442	70,476	70,509	70,541	70,570	70,599	70,628	70,656
Prince George's	83,987	84,069	84,149	84,257	84,330	84,399	84,467	84,531	84,597	84,659	84,718

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Anne Arundel	43,148	43,197	43,248	43,301	43,394 (8,679) [2,083] {1,041}	43,480 (8,696) [2,087] {1,044}	43,563 (8,713) [2,091] {1,046}
Baltimore City	51,969	52,015	52,099	52,153	52,281 (10,456) [2,509] {1,255}	52,397 (10,479) [2,515] {1,258}	52,504 (10,501) [2,520] {1,260}
Baltimore County	64,579	64,636	64,724	64,807	64,950 (12,990) [3,118] {1,559}	65,076 (13,015) [3,124] {1,562}	65,188 (13,038) [3,129] {1,565}
Charles	10,677	10,685	10,698	10,713	10,733 (2,147) [515] {258}	10,751 (2,150) [516] {258}	10,768 (2,154) [517] {258}
Frederick	19,590	19,604	19,614	19,631	19,650 (3,930) [943] {472}	19,667 (3,933) [944] {472}	19,683 (3,937) [945] {472}
Harford	16,292	16,316	16,328	16,349	16,377 (3,275) [786] {393}	16,403 (3,281) [787] {394}	16,427 (3,285) [788] {394}
Howard	19,033	19,036	19,053	19,067	19,088 (3,818) [916] {458}	19,107 (3,821) [917] {459}	19,123 (3,825) [918] {459}
Montgomery	70,298	70,353	70,394	70,442	70,509 (14,102) [3,384] {1,692}	70,570 (14,114) [3,387] {1,694}	70,628 (14,126) [3,390] {1,695}
Prince George's	83,987	84,069	84,149	84,257	84,399 (16,880) [4,051] {2,026}	84,531 (16,906) [4,058] {2,029}	84,659 (16,932) [4,064] {2,032}

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.