IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/1/21

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 6/1/21 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
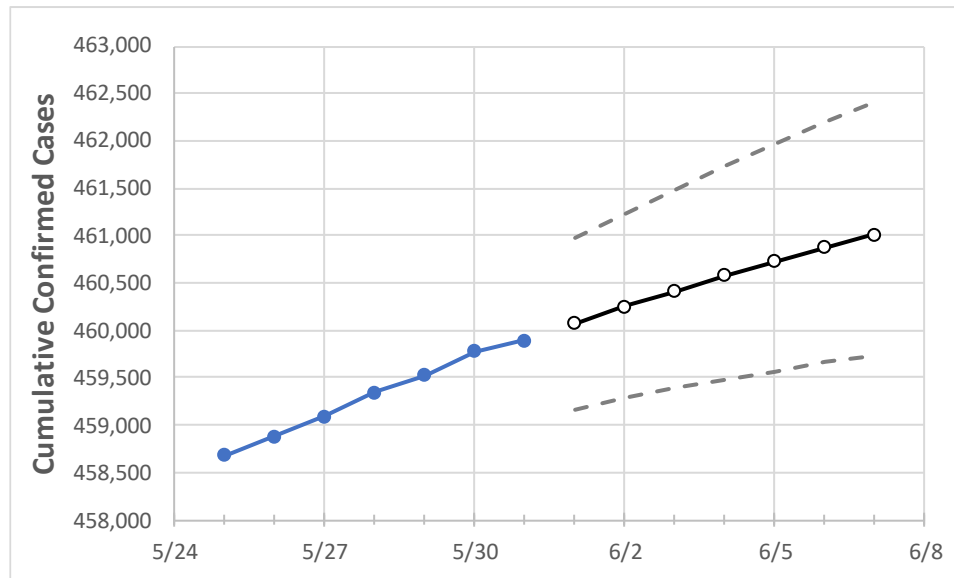
	Actual Confirmed Cases On:				Projected Cases For:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Maryland	459,343	459,528	459,777	459,894	460,076	460,250	460,416	460,577	460,731	460,878	461,013

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Anne Arundel	43,730	43,750	43,769	43,778	43,792	43,806	43,819	43,831	43,842	43,852	43,862
Baltimore City	52,797	52,820	52,839	52,852	52,874	52,896	52,916	52,935	52,953	52,971	52,987
Baltimore County	65,557	65,589	65,612	65,627	65,654	65,680	65,705	65,730	65,754	65,777	65,798
Charles	10,854	10,856	10,861	10,865	10,873	10,881	10,888	10,895	10,903	10,910	10,917
Frederick	19,758	19,769	19,772	19,773	19,778	19,784	19,789	19,794	19,798	19,803	19,807
Harford	16,546	16,555	16,559	16,563	16,570	16,576	16,582	16,588	16,593	16,598	16,603
Howard	19,195	19,201	19,207	19,210	19,215	19,220	19,225	19,229	19,234	19,238	19,242
Montgomery	70,806	70,903	70,921	70,930	70,954	70,979	71,003	71,026	71,049	71,072	71,096
Prince George's	84,990	85,033	85,056	85,079	85,105	85,131	85,156	85,179	85,202	85,223	85,242

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:		
	5/28	5/29	5/30	5/31	6/2	6/4	6/6
Anne Arundel	43,730	43,750	43,769	43,778	43,806 (8,761) [2,103] {1,051}	43,831 (8,766) [2,104] {1,052}	43,852 (8,770) [2,105] {1,052}
Baltimore City	52,797	52,820	52,839	52,852	52,896 (10,579) [2,539] {1,269}	52,935 (10,587) [2,541] {1,270}	52,971 (10,594) [2,543] {1,271}
Baltimore County	65,557	65,589	65,612	65,627	65,680 (13,136) [3,153] {1,576}	65,730 (13,146) [3,155] {1,578}	65,777 (13,155) [3,157] {1,579}
Charles	10,854	10,856	10,861	10,865	10,881 (2,176) [522] {261}	10,895 (2,179) [523] {261}	10,910 (2,182) [524] {262}
Frederick	19,758	19,769	19,772	19,773	19,784 (3,957) [950] {475}	19,794 (3,959) [950] {475}	19,803 (3,961) [951] {475}
Harford	16,546	16,555	16,559	16,563	16,576 (3,315) [796] {398}	16,588 (3,318) [796] {398}	16,598 (3,320) [797] {398}
Howard	19,195	19,201	19,207	19,210	19,220 (3,844) [923] {461}	19,229 (3,846) [923] {462}	19,238 (3,848) [923] {462}
Montgomery	70,806	70,903	70,921	70,930	70,979 (14,196) [3,407] {1,703}	71,026 (14,205) [3,409] {1,705}	71,072 (14,214) [3,411] {1,706}
Prince George's	84,990	85,033	85,056	85,079	85,131 (17,026) [4,086] {2,043}	85,179 (17,036) [4,089] {2,044}	85,223 (17,045) [4,091] {2,045}

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.