IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/21

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 8/4/21 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
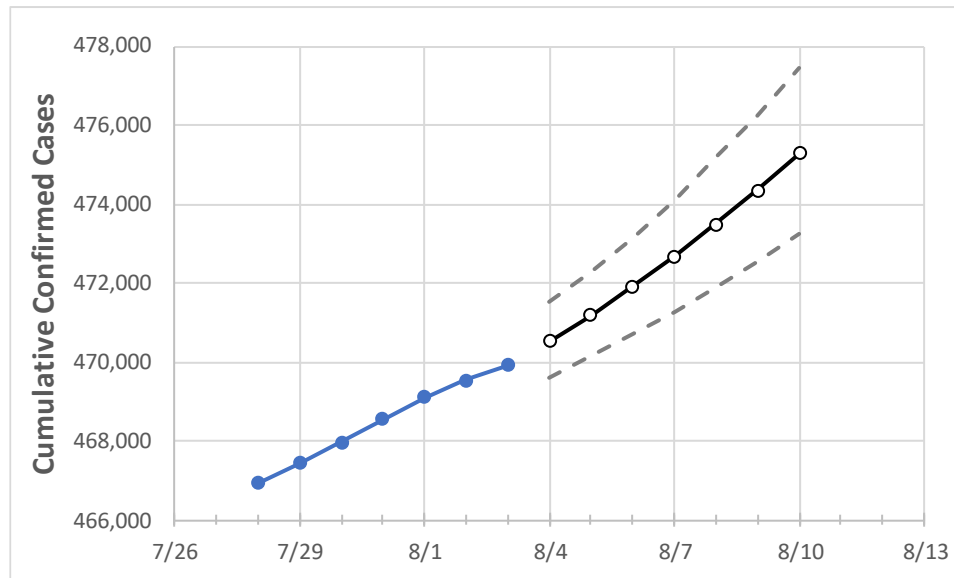
	Actual Confirmed Cases On:				Projected Cases For:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Maryland	468,548	469,095	469,542	469,910	470,526	471,193	471,906	472,665	473,486	474,357	475,295

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Anne Arundel	44,626	44,682	44,721	44,760	44,822	44,887	44,958	45,033	45,112	45,196	45,287
Baltimore City	53,692	53,743	53,777	53,809	53,863	53,921	53,984	54,050	54,121	54,196	54,277
Baltimore County	66,693	66,744	66,797	66,839	66,911	66,987	67,069	67,159	67,253	67,354	67,461
Charles	11,211	11,231	11,244	11,273	11,301	11,331	11,364	11,400	11,439	11,481	11,527
Frederick	20,103	20,129	20,152	20,195	20,231	20,271	20,316	20,365	20,418	20,477	20,544
Harford	16,896	16,918	16,934	16,952	16,978	17,006	17,037	17,069	17,105	17,144	17,186
Howard	19,619	19,634	19,646	19,662	19,684	19,707	19,732	19,758	19,785	19,815	19,844
Montgomery	72,276	72,342	72,383	72,481	72,584	72,697	72,814	72,942	73,079	73,226	73,383
Prince George's	86,871	86,971	87,051	87,196	87,326	87,466	87,617	87,778	87,950	88,135	88,334

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Anne Arundel	44,626	44,682	44,721	44,760	44,887 (8,977) [2,155] {1,077}	45,033 (9,007) [2,162] {1,081}	45,196 (9,039) [2,169] {1,085}
Baltimore City	53,692	53,743	53,777	53,809	53,921 (10,784) [2,588] {1,294}	54,050 (10,810) [2,594] {1,297}	54,196 (10,839) [2,601] {1,301}
Baltimore County	66,693	66,744	66,797	66,839	66,987 (13,397) [3,215] {1,608}	67,159 (13,432) [3,224] {1,612}	67,354 (13,471) [3,233] {1,616}
Charles	11,211	11,231	11,244	11,273	11,331 (2,266) [544] {272}	11,400 (2,280) [547] {274}	11,481 (2,296) [551] {276}
Frederick	20,103	20,129	20,152	20,195	20,271 (4,054) [973] {487}	20,365 (4,073) [978] {489}	20,477 (4,095) [983] {491}
Harford	16,896	16,918	16,934	16,952	17,006 (3,401) [816] {408}	17,069 (3,414) [819] {410}	17,144 (3,429) [823] {411}
Howard	19,619	19,634	19,646	19,662	19,707 (3,941) [946] {473}	19,758 (3,952) [948] {474}	19,815 (3,963) [951] {476}
Montgomery	72,276	72,342	72,383	72,481	72,697 (14,539) [3,489] {1,745}	72,942 (14,588) [3,501] {1,751}	73,226 (14,645) [3,515] {1,757}
Prince George's	86,871	86,971	87,051	87,196	87,466 (17,493) [4,198] {2,099}	87,778 (17,556) [4,213] {2,107}	88,135 (17,627) [4,230] {2,115}

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.