IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/2/21

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 7/2/21 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
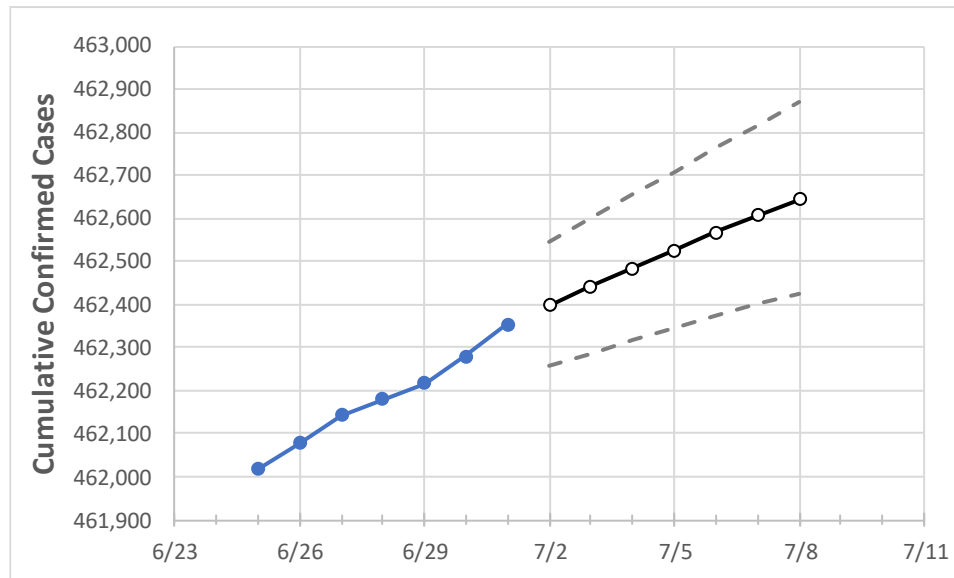
	Actual Confirmed Cases On:				Projected Cases For:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Maryland	462,181	462,217	462,279	462,354	462,399	462,442	462,485	462,527	462,567	462,606	462,645

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Anne Arundel	43,966	43,967	43,974	43,978	43,982	43,985	43,988	43,992	43,995	43,998	44,001
Baltimore City	53,132	53,133	53,141	53,148	53,153	53,158	53,163	53,168	53,172	53,177	53,181
Baltimore County	65,939	65,943	65,948	65,958	65,964	65,970	65,976	65,980	65,986	65,991	65,996
Charles	10,963	10,966	10,968	10,970	10,971	10,972	10,973	10,974	10,975	10,976	10,977
Frederick	19,833	19,834	19,837	19,841	19,842	19,843	19,844	19,845	19,847	19,848	19,849
Harford	16,648	16,650	16,655	16,658	16,660	16,662	16,664	16,665	16,667	16,668	16,670
Howard	19,323	19,324	19,325	19,332	19,334	19,337	19,339	19,341	19,343	19,345	19,347
Montgomery	71,171	71,180	71,190	71,209	71,216	71,224	71,231	71,238	71,245	71,252	71,259
Prince George's	85,526	85,533	85,540	85,556	85,564	85,571	85,579	85,586	85,593	85,599	85,606

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:		
	6/28	6/29	6/30	7/1	7/3	7/5	7/7
Anne Arundel	43,966	43,967	43,974	43,978	43,985 (8,797) [2,111] {1,056}	43,992 (8,798) [2,112] {1,056}	43,998 (8,800) [2,112] {1,056}
Baltimore City	53,132	53,133	53,141	53,148	53,158 (10,632) [2,552] {1,276}	53,168 (10,634) [2,552] {1,276}	53,177 (10,635) [2,552] {1,276}
Baltimore County	65,939	65,943	65,948	65,958	65,970 (13,194) [3,167] {1,583}	65,980 (13,196) [3,167] {1,584}	65,991 (13,198) [3,168] {1,584}
Charles	10,963	10,966	10,968	10,970	10,972 (2,194) [527] {263}	10,974 (2,195) [527] {263}	10,976 (2,195) [527] {263}
Frederick	19,833	19,834	19,837	19,841	19,843 (3,969) [952] {476}	19,845 (3,969) [953] {476}	19,848 (3,970) [953] {476}
Harford	16,648	16,650	16,655	16,658	16,662 (3,332) [800] {400}	16,665 (3,333) [800] {400}	16,668 (3,334) [800] {400}
Howard	19,323	19,324	19,325	19,332	19,337 (3,867) [928] {464}	19,341 (3,868) [928] {464}	19,345 (3,869) [929] {464}
Montgomery	71,171	71,180	71,190	71,209	71,224 (14,245) [3,419] {1,709}	71,238 (14,248) [3,419] {1,710}	71,252 (14,250) [3,420] {1,710}
Prince George's	85,526	85,533	85,540	85,556	85,571 (17,114) [4,107] {2,054}	85,586 (17,117) [4,108] {2,054}	85,599 (17,120) [4,109] {2,054}

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.