IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/24/21

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 2/24/21 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
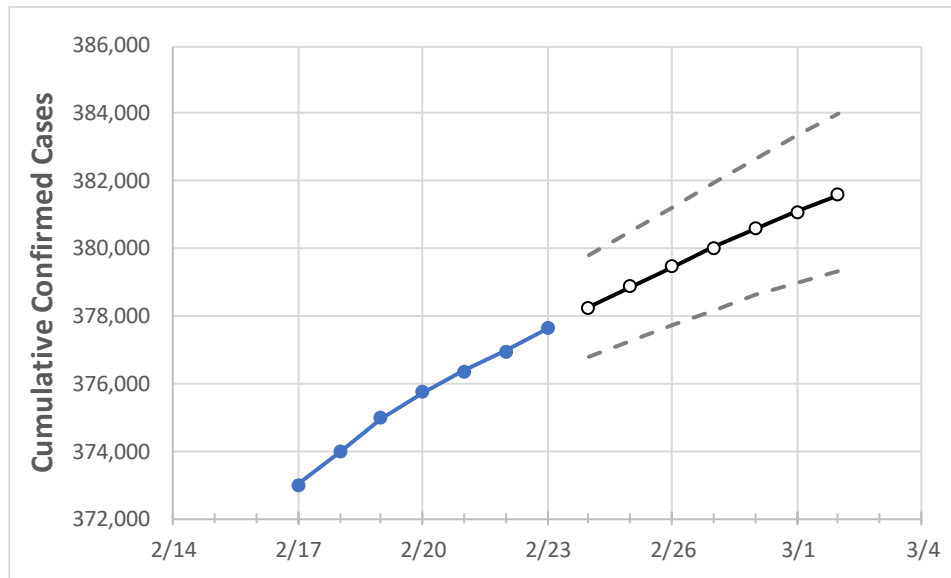
	Actual Confirmed Cases On:				Projected Cases For:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Maryland	375,737	376,355	376,966	377,628	378,263	378,876	379,468	380,025	380,573	381,094	381,583

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Anne Arundel	35,040	35,094	35,166	35,218	35,285	35,349	35,411	35,473	35,532	35,591	35,646
Baltimore City	39,785	39,839	39,899	39,980	40,038	40,094	40,148	40,200	40,249	40,297	40,344
Baltimore County	49,977	50,063	50,132	50,194	50,277	50,355	50,431	50,505	50,575	50,644	50,708
Charles	8,733	8,751	8,771	8,801	8,821	8,841	8,860	8,879	8,897	8,915	8,932
Frederick	16,691	16,715	16,747	16,778	16,809	16,839	16,868	16,895	16,921	16,947	16,972
Harford	12,262	12,285	12,309	12,336	12,366	12,396	12,425	12,452	12,478	12,503	12,529
Howard	15,505	15,519	15,568	15,603	15,635	15,668	15,699	15,728	15,758	15,787	15,815
Montgomery	62,436	62,523	62,626	62,767	62,860	62,949	63,037	63,117	63,194	63,272	63,346
Prince George's	72,122	72,250	72,416	72,609	72,747	72,879	73,008	73,134	73,254	73,372	73,489

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:		
	2/20	2/21	2/22	2/23	2/25	2/27	3/1
Anne Arundel	35,040	35,094	35,166	35,218	35,349 (7,070) [1,697] {848}	35,473 (7,095) [1,703] {851}	35,591 (7,118) [1,708] {854}
Baltimore City	39,785	39,839	39,899	39,980	40,094 (8,019) [1,925] {962}	40,200 (8,040) [1,930] {965}	40,297 (8,059) [1,934] {967}
Baltimore County	49,977	50,063	50,132	50,194	50,355 (10,071) [2,417] {1,209}	50,505 (10,101) [2,424] {1,212}	50,644 (10,129) [2,431] {1,215}
Charles	8,733	8,751	8,771	8,801	8,841 (1,768) [424] {212}	8,879 (1,776) [426] {213}	8,915 (1,783) [428] {214}
Frederick	16,691	16,715	16,747	16,778	16,839 (3,368) [808] {404}	16,895 (3,379) [811] {405}	16,947 (3,389) [813] {407}
Harford	12,262	12,285	12,309	12,336	12,396 (2,479) [595] {298}	12,452 (2,490) [598] {299}	12,503 (2,501) [600] {300}
Howard	15,505	15,519	15,568	15,603	15,668 (3,134) [752] {376}	15,728 (3,146) [755] {377}	15,787 (3,157) [758] {379}
Montgomery	62,436	62,523	62,626	62,767	62,949 (12,590) [3,022] {1,511}	63,117 (12,623) [3,030] {1,515}	63,272 (12,654) [3,037] {1,519}
Prince George's	72,122	72,250	72,416	72,609	72,879 (14,576) [3,498] {1,749}	73,134 (14,627) [3,510] {1,755}	73,372 (14,674) [3,522] {1,761}

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.