IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/20/20

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 10/20/20 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
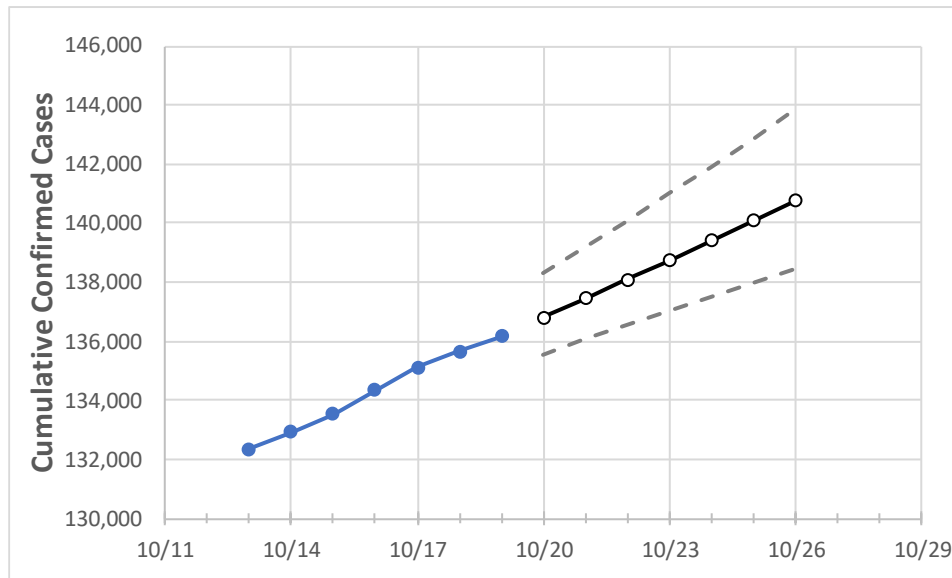
	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Maryland	134,329	135,127	135,657	136,154	136,791	137,436	138,088	138,747	139,414	140,090	140,773

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 20%, and are often within 10%, of actual confirmed cases.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Anne Arundel	11,151	11,222	11,265	11,336	11,407	11,479	11,553	11,628	11,704	11,781	11,860
Baltimore City	16,681	16,773	16,842	16,906	16,966	17,027	17,089	17,151	17,215	17,279	17,343
Baltimore County	19,403	19,494	19,565	19,646	19,745	19,846	19,950	20,057	20,165	20,277	20,391
Charles	3,007	3,018	3,029	3,041	3,053	3,065	3,077	3,089	3,102	3,114	3,127
Frederick	4,498	4,519	4,534	4,546	4,569	4,593	4,616	4,640	4,664	4,689	4,714
Harford	3,353	3,374	3,395	3,417	3,438	3,460	3,482	3,504	3,527	3,551	3,575
Howard	5,534	5,566	5,580	5,605	5,628	5,652	5,675	5,698	5,722	5,746	5,769
Montgomery	24,291	24,395	24,466	24,560	24,673	24,787	24,904	25,022	25,143	25,265	25,390
Prince George's	31,582	31,698	31,813	31,864	31,964	32,064	32,165	32,266	32,367	32,469	32,571

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:		
	10/16	10/17	10/18	10/19	10/21	10/23	10/25
Anne Arundel	11,151	11,222	11,265	11,336	11,479 (2,296) [551] {276}	11,628 (2,326) [558] {279}	11,781 (2,356) [565] {283}
Baltimore City	16,681	16,773	16,842	16,906	17,027 (3,405) [817] {409}	17,151 (3,430) [823] {412}	17,279 (3,456) [829] {415}
Baltimore County	19,403	19,494	19,565	19,646	19,846 (3,969) [953] {476}	20,057 (4,011) [963] {481}	20,277 (4,055) [973] {487}
Charles	3,007	3,018	3,029	3,041	3,065 (613) [147] {74}	3,089 (618) [148] {74}	3,114 (623) [149] {75}
Frederick	4,498	4,519	4,534	4,546	4,593 (919) [220] {110}	4,640 (928) [223] {111}	4,689 (938) [225] {113}
Harford	3,353	3,374	3,395	3,417	3,460 (692) [166] {83}	3,504 (701) [168] {84}	3,551 (710) [170] {85}
Howard	5,534	5,566	5,580	5,605	5,652 (1,130) [271] {136}	5,698 (1,140) [274] {137}	5,746 (1,149) [276] {138}
Montgomery	24,291	24,395	24,466	24,560	24,787 (4,957) [1,190] {595}	25,022 (5,004) [1,201] {601}	25,265 (5,053) [1,213] {606}
Prince George's	31,582	31,698	31,813	31,864	32,064 (6,413) [1,539] {770}	32,266 (6,453) [1,549] {774}	32,469 (6,494) [1,559] {779}

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.