IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/23/20

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 <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 10/23/20 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
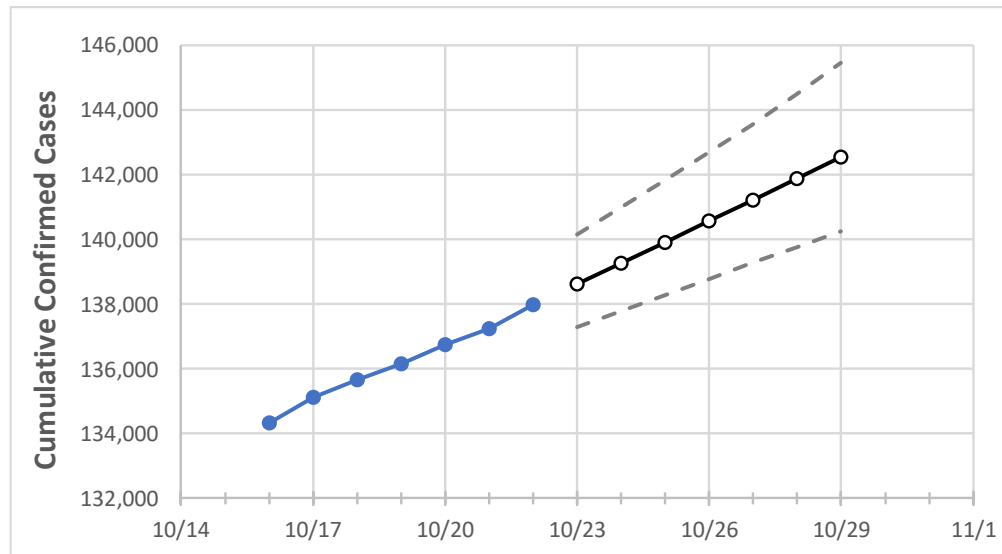
	Actual Confirmed Cases On:				Projected Cases For:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
Maryland	136,154	136,744	137,236	137,979	138,615	139,257	139,904	140,557	141,215	141,879	142,549

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:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
Anne Arundel	11,336	11,391	11,433	11,514	11,581	11,649	11,717	11,786	11,856	11,926	11,996
Baltimore City	16,906	16,937	17,000	17,079	17,136	17,193	17,251	17,309	17,368	17,427	17,487
Baltimore County	19,646	19,749	19,799	19,897	19,987	20,079	20,172	20,266	20,361	20,457	20,554
Charles	3,041	3,050	3,067	3,078	3,090	3,101	3,113	3,125	3,136	3,148	3,160
Frederick	4,546	4,559	4,581	4,610	4,631	4,653	4,675	4,696	4,718	4,740	4,762
Harford	3,417	3,430	3,448	3,482	3,504	3,526	3,548	3,571	3,595	3,619	3,643
Howard	5,605	5,628	5,647	5,684	5,708	5,732	5,756	5,780	5,804	5,828	5,852
Montgomery	24,560	24,664	24,772	24,877	24,991	25,107	25,224	25,343	25,464	25,587	25,711
Prince George's	31,864	31,980	32,057	32,216	32,319	32,422	32,525	32,629	32,733	32,838	32,943

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:		
	10/19	10/20	10/21	10/22	10/24	10/26	10/28
Anne Arundel	11,336	11,391	11,433	11,514	11,649 (2,330) [559] {280}	11,786 (2,357) [566] {283}	11,926 (2,385) [572] {286}
Baltimore City	16,906	16,937	17,000	17,079	17,193 (3,439) [825] {413}	17,309 (3,462) [831] {415}	17,427 (3,485) [836] {418}
Baltimore County	19,646	19,749	19,799	19,897	20,079 (4,016) [964] {482}	20,266 (4,053) [973] {486}	20,457 (4,091) [982] {491}
Charles	3,041	3,050	3,067	3,078	3,101 (620) [149] {74}	3,125 (625) [150] {75}	3,148 (630) [151] {76}
Frederick	4,546	4,559	4,581	4,610	4,653 (931) [223] {112}	4,696 (939) [225] {113}	4,740 (948) [228] {114}
Harford	3,417	3,430	3,448	3,482	3,526 (705) [169] {85}	3,571 (714) [171] {86}	3,619 (724) [174] {87}
Howard	5,605	5,628	5,647	5,684	5,732 (1,146) [275] {138}	5,780 (1,156) [277] {139}	5,828 (1,166) [280] {140}
Montgomery	24,560	24,664	24,772	24,877	25,107 (5,021) [1,205] {603}	25,343 (5,069) [1,216] {608}	25,587 (5,117) [1,228] {61}
Prince George's	31,864	31,980	32,057	32,216	32,422 (6,484) [1,556] {778}	32,629 (6,526) [1,566] {783}	32,838 (6,568) [1,576] {78}

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.