IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/28/21

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 1/28/21 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
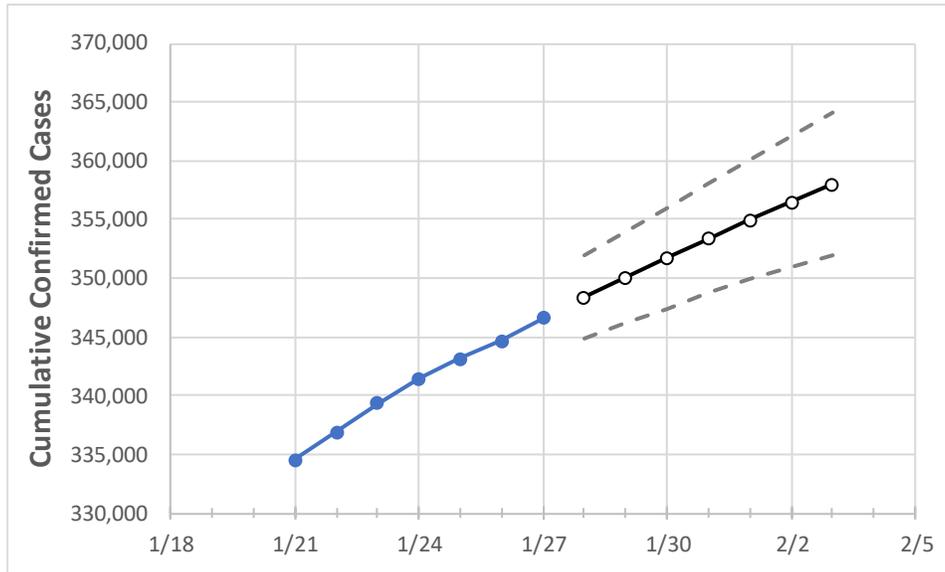
	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Maryland	341,452	343,138	344,620	346,559	348,328	350,070	351,747	353,367	354,945	356,483	357,953

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Anne Arundel	31,599	31,764	31,909	32,093	32,274	32,446	32,609	32,768	32,923	33,071	33,215
Baltimore City	36,886	37,023	37,087	37,281	37,425	37,564	37,706	37,838	37,966	38,089	38,218
Baltimore County	45,671	45,847	46,027	46,254	46,450	46,644	46,828	47,010	47,189	47,364	47,533
Charles	7,667	7,719	7,786	7,833	7,892	7,952	8,009	8,068	8,126	8,183	8,240
Frederick	15,113	15,216	15,239	15,342	15,418	15,491	15,559	15,623	15,689	15,752	15,809
Harford	10,821	10,896	10,957	11,039	11,115	11,190	11,263	11,336	11,406	11,478	11,549
Howard	14,028	14,077	14,138	14,250	14,318	14,385	14,451	14,514	14,575	14,635	14,693
Montgomery	57,129	57,326	57,685	58,011	58,349	58,678	59,010	59,342	59,662	59,976	60,293
Prince George's	65,865	66,159	66,535	66,888	67,187	67,472	67,753	68,015	68,280	68,535	68,781

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Anne Arundel	31,599	31,764	31,909	32,093	32,446 (6,489) [1,557] {779}	32,768 (6,554) [1,573] {786}	33,071 (6,614) [1,587] {794}
Baltimore City	36,886	37,023	37,087	37,281	37,564 (7,513) [1,803] {902}	37,838 (7,568) [1,816] {908}	38,089 (7,618) [1,828] {914}
Baltimore County	45,671	45,847	46,027	46,254	46,644 (9,329) [2,239] {1,119}	47,010 (9,402) [2,256] {1,128}	47,364 (9,473) [2,273] {1,137}
Charles	7,667	7,719	7,786	7,833	7,952 (1,590) [382] {191}	8,068 (1,614) [387] {194}	8,183 (1,637) [393] {196}
Frederick	15,113	15,216	15,239	15,342	15,491 (3,098) [744] {372}	15,623 (3,125) [750] {375}	15,752 (3,150) [756] {378}
Harford	10,821	10,896	10,957	11,039	11,190 (2,238) [537] {269}	11,336 (2,267) [544] {272}	11,478 (2,296) [551] {275}
Howard	14,028	14,077	14,138	14,250	14,385 (2,877) [690] {345}	14,514 (2,903) [697] {348}	14,635 (2,927) [702] {351}
Montgomery	57,129	57,326	57,685	58,011	58,678 (11,736) [2,817] {1,408}	59,342 (11,868) [2,848] {1,424}	59,976 (11,995) [2,879] {1,439}
Prince George's	65,865	66,159	66,535	66,888	67,472 (13,494) [3,239] {1,619}	68,015 (13,603) [3,265] {1,632}	68,535 (13,707) [3,290] {1,645}

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.