IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/25/21

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 1/25/21 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
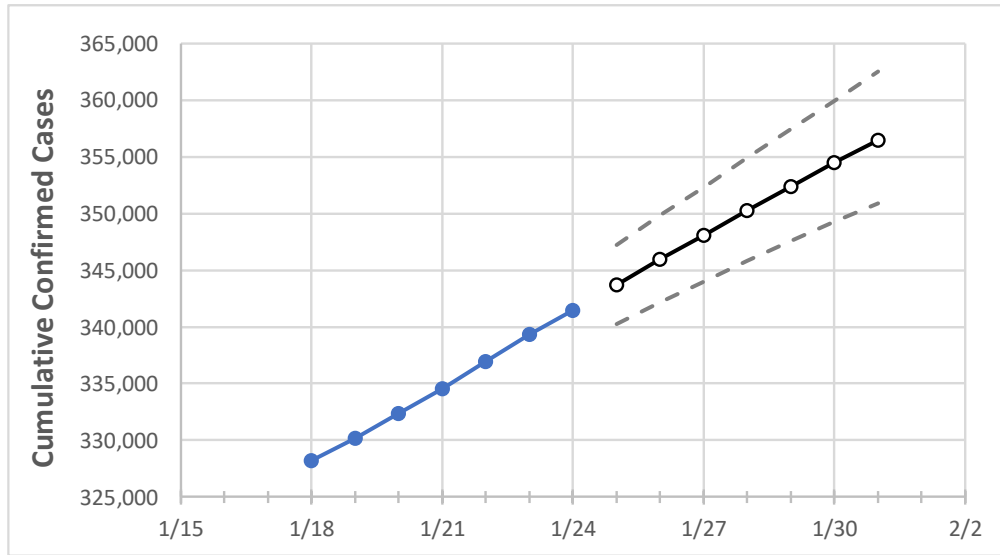
	Actual Confirmed Cases On:				Projected Cases For:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Maryland	334,519	336,915	339,307	341,452	343,689	345,920	348,090	350,250	352,365	354,452	356,470

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Anne Arundel	30,847	31,125	31,396	31,599	31,848	32,100	32,343	32,588	32,824	33,060	33,287
Baltimore City	36,283	36,453	36,688	36,886	37,075	37,263	37,457	37,645	37,828	38,009	38,187
Baltimore County	44,944	45,197	45,459	45,671	45,926	46,178	46,425	46,672	46,915	47,161	47,394
Charles	7,412	7,470	7,551	7,667	7,736	7,805	7,875	7,944	8,016	8,089	8,164
Frederick	14,693	14,817	14,925	15,113	15,243	15,371	15,499	15,623	15,746	15,868	15,988
Harford	10,541	10,649	10,736	10,821	10,913	11,002	11,093	11,182	11,272	11,363	11,454
Howard	13,744	13,860	13,954	14,028	14,124	14,219	14,312	14,404	14,494	14,583	14,670
Montgomery	55,531	55,951	56,328	57,129	57,524	57,908	58,299	58,685	59,067	59,457	59,835
Prince George's	64,414	64,830	65,151	65,865	66,259	66,662	67,054	67,447	67,839	68,229	68,627

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:		
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Anne Arundel	30,847	31,125	31,396	31,599	32,100 (6,420) [1,541] {770}	32,588 (6,518) [1,564] {782}	33,060 (6,612) [1,587] {793}
Baltimore City	36,283	36,453	36,688	36,886	37,263 (7,453) [1,789] {894}	37,645 (7,529) [1,807] {903}	38,009 (7,602) [1,824] {912}
Baltimore County	44,944	45,197	45,459	45,671	46,178 (9,236) [2,217] {1,108}	46,672 (9,334) [2,240] {1,120}	47,161 (9,432) [2,264] {1,132}
Charles	7,412	7,470	7,551	7,667	7,805 (1,561) [375] {187}	7,944 (1,589) [381] {191}	8,089 (1,618) [388] {194}
Frederick	14,693	14,817	14,925	15,113	15,371 (3,074) [738] {369}	15,623 (3,125) [750] {375}	15,868 (3,174) [762] {381}
Harford	10,541	10,649	10,736	10,821	11,002 (2,200) [528] {264}	11,182 (2,236) [537] {268}	11,363 (2,273) [545] {273}
Howard	13,744	13,860	13,954	14,028	14,219 (2,844) [682] {341}	14,404 (2,881) [691] {346}	14,583 (2,917) [700] {350}
Montgomery	55,531	55,951	56,328	57,129	57,908 (11,582) [2,780] {1,390}	58,685 (11,737) [2,817] {1,408}	59,457 (11,891) [2,854] {1,427}
Prince George's	64,414	64,830	65,151	65,865	66,662 (13,332) [3,200] {1,600}	67,447 (13,489) [3,237] {1,619}	68,229 (13,646) [3,275] {1,637}

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.