IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/24/20

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 11/24/20 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
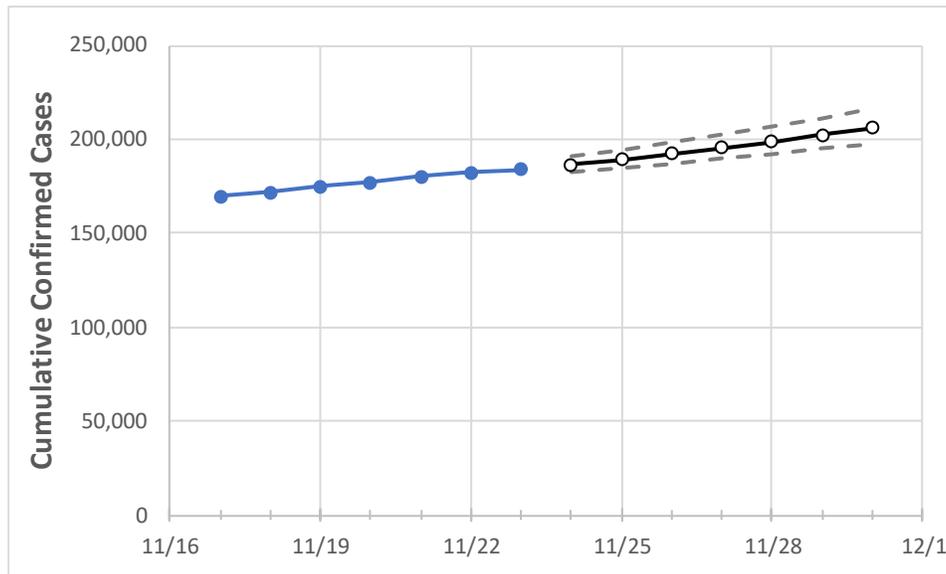
	Actual Confirmed Cases On:				Projected Cases For:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Maryland	177,086	179,971	182,139	183,797	186,551	189,429	192,436	195,580	198,864	202,295	205,879

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Anne Arundel	15,103	15,294	15,471	15,587	15,800	16,020	16,248	16,484	16,728	16,980	17,242
Baltimore City	22,010	22,466	22,699	22,932	23,265	23,613	23,975	24,353	24,746	25,156	25,584
Baltimore County	26,088	26,583	26,967	27,223	27,665	28,127	28,611	29,118	29,648	30,203	30,784
Charles	3,990	4,025	4,065	4,104	4,155	4,208	4,263	4,319	4,377	4,437	4,499
Frederick	6,036	6,139	6,198	6,267	6,365	6,467	6,574	6,685	6,802	6,923	7,050
Harford	5,184	5,344	5,461	5,537	5,682	5,836	5,998	6,169	6,350	6,541	6,742
Howard	7,201	7,340	7,398	7,488	7,596	7,710	7,829	7,954	8,085	8,222	8,367
Montgomery	30,882	31,176	31,389	31,622	31,959	32,306	32,663	33,031	33,411	33,801	34,204
Prince George's	37,271	38,092	38,913	39,200	39,685	40,198	40,741	41,314	41,920	42,561	43,238

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:		
	11/20	11/21	11/22	11/23	11/25	11/27	11/29
Anne Arundel	15,103	15,294	15,471	15,587	16,020 (3,204) [769] {384}	16,484 (3,297) [791] {396}	16,980 (3,396) [815] {408}
Baltimore City	22,010	22,466	22,699	22,932	23,613 (4,723) [1,133] {567}	24,353 (4,871) [1,169] {584}	25,156 (5,031) [1,208] {604}
Baltimore County	26,088	26,583	26,967	27,223	28,127 (5,625) [1,350] {675}	29,118 (5,824) [1,398] {699}	30,203 (6,041) [1,450] {725}
Charles	3,990	4,025	4,065	4,104	4,208 (842) [202] {101}	4,319 (864) [207] {104}	4,437 (887) [213] {106}
Frederick	6,036	6,139	6,198	6,267	6,467 (1,293) [310] {155}	6,685 (1,337) [321] {160}	6,923 (1,385) [332] {166}
Harford	5,184	5,344	5,461	5,537	5,836 (1,167) [280] {140}	6,169 (1,234) [296] {148}	6,541 (1,308) [314] {157}
Howard	7,201	7,340	7,398	7,488	7,710 (1,542) [370] {185}	7,954 (1,591) [382] {191}	8,222 (1,644) [395] {197}
Montgomery	30,882	31,176	31,389	31,622	32,306 (6,461) [1,551] {775}	33,031 (6,606) [1,585] {793}	33,801 (6,760) [1,622] {811}
Prince George's	37,271	38,092	38,913	39,200	40,198 (8,040) [1,930] {965}	41,314 (8,263) [1,983] {992}	42,561 (8,512) [2,043] {1,021}

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.