IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/26/21

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 3/26/21 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.

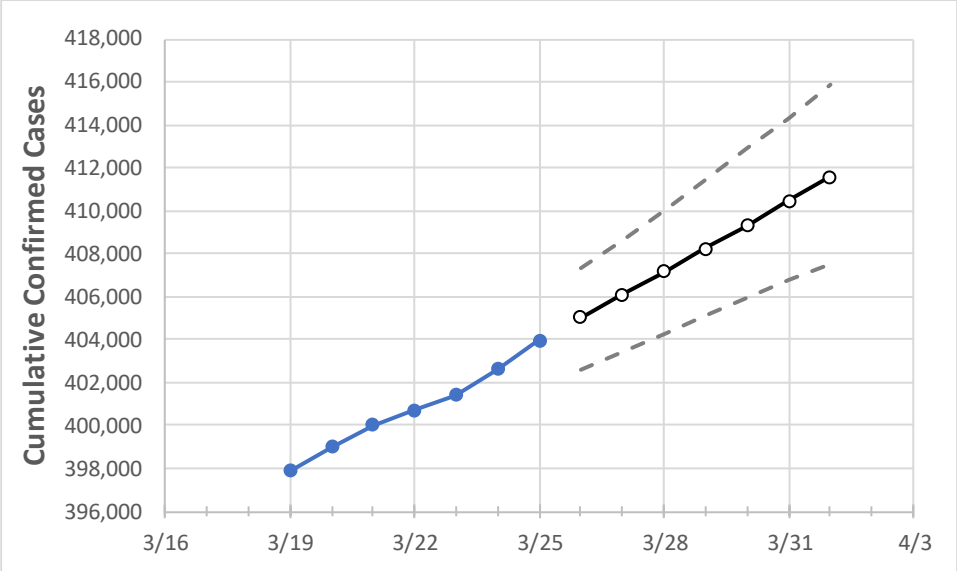
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Maryland	400,705	401,427	402,600	403,982	405,037	406,112	407,161	408,237	409,328	410,468	411,571

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Anne Arundel	37,799	37,879	38,011	38,186	38,304	38,424	38,549	38,670	38,796	38,923	39,055
Baltimore City	42,839	42,970	43,156	43,351	43,536	43,726	43,924	44,129	44,341	44,558	44,787
Baltimore County	53,914	54,031	54,243	54,484	54,658	54,840	55,022	55,209	55,395	55,589	55,782
Charles	9,484	9,531	9,556	9,596	9,627	9,658	9,691	9,723	9,755	9,787	9,820
Frederick	17,788	17,838	17,893	17,961	18,008	18,056	18,103	18,151	18,200	18,251	18,302
Harford	13,376	13,415	13,472	13,550	13,607	13,667	13,726	13,787	13,851	13,914	13,979
Howard	16,776	16,798	16,848	16,915	16,958	17,000	17,043	17,085	17,128	17,172	17,214
Montgomery	65,686	65,825	65,986	66,113	66,234	66,358	66,482	66,607	66,734	66,860	66,989
Prince George's	76,587	76,750	76,950	77,153	77,310	77,471	77,633	77,797	77,960	78,127	78,292

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Anne Arundel	37,799	37,879	38,011	38,186	38,424 (7,685) [1,844] {922}	38,670 (7,734) [1,856] {928}	38,923 (7,785) [1,868] {934}
Baltimore City	42,839	42,970	43,156	43,351	43,726 (8,745) [2,099] {1,049}	44,129 (8,826) [2,118] {1,059}	44,558 (8,912) [2,139] {1,069}
Baltimore County	53,914	54,031	54,243	54,484	54,840 (10,968) [2,632] {1,316}	55,209 (11,042) [2,650] {1,325}	55,589 (11,118) [2,668] {1,334}
Charles	9,484	9,531	9,556	9,596	9,658 (1,932) [464] {232}	9,723 (1,945) [467] {233}	9,787 (1,957) [470] {235}
Frederick	17,788	17,838	17,893	17,961	18,056 (3,611) [867] {433}	18,151 (3,630) [871] {436}	18,251 (3,650) [876] {438}
Harford	13,376	13,415	13,472	13,550	13,667 (2,733) [656] {328}	13,787 (2,757) [662] {331}	13,914 (2,783) [668] {334}
Howard	16,776	16,798	16,848	16,915	17,000 (3,400) [816] {408}	17,085 (3,417) [820] {410}	17,172 (3,434) [824] {412}
Montgomery	65,686	65,825	65,986	66,113	66,358 (13,272) [3,185] {1,593}	66,607 (13,321) [3,197] {1,599}	66,860 (13,372) [3,209] {1,605}
Prince George's	76,587	76,750	76,950	77,153	77,471 (15,494) [3,719] {1,859}	77,797 (15,559) [3,734] {1,867}	78,127 (15,625) [3,750] {1,875}

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.