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

Date: 1/8/21

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 1/8/21 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.

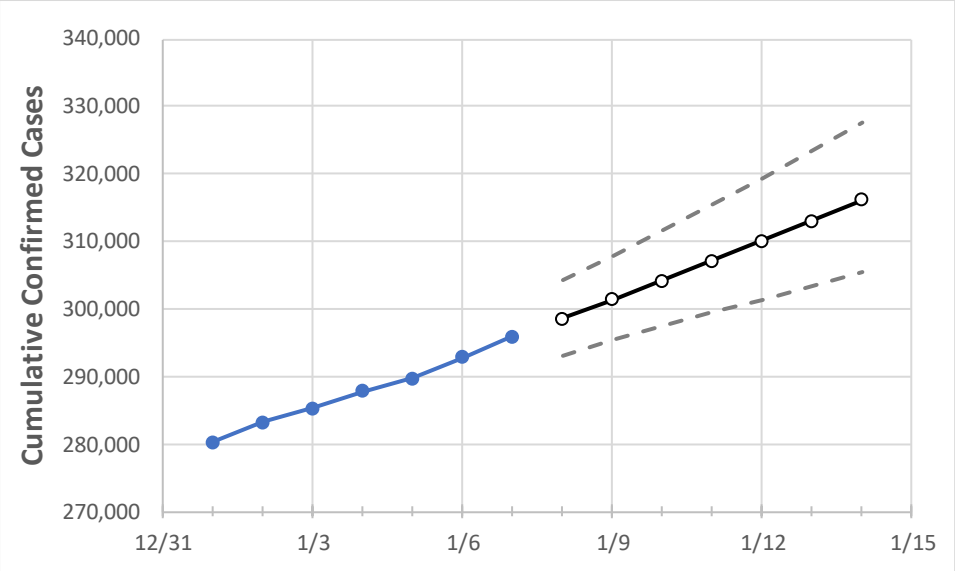
IEM's Modeling Lead

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Maryland	287,802	289,758	292,904	295,874	298,612	301,429	304,269	307,173	310,097	313,081	316,119

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Anne Arundel	25,629	25,781	26,130	26,478	26,780	27,082	27,389	27,712	28,025	28,352	28,681
Baltimore City	32,503	32,689	32,982	33,215	33,459	33,708	33,962	34,222	34,486	34,755	35,025
Baltimore County	39,851	40,026	40,428	40,759	41,067	41,380	41,703	42,035	42,369	42,701	43,038
Charles	6,328	6,396	6,471	6,534	6,597	6,659	6,724	6,788	6,853	6,918	6,986
Frederick	12,190	12,309	12,446	12,592	12,758	12,925	13,093	13,266	13,441	13,617	13,797
Harford	8,957	9,005	9,116	9,195	9,287	9,382	9,478	9,575	9,673	9,775	9,878
Howard	11,657	11,744	11,885	12,029	12,150	12,274	12,402	12,528	12,658	12,794	12,926
Montgomery	48,351	48,864	49,257	49,806	50,273	50,745	51,227	51,718	52,216	52,728	53,226
Prince George's	56,813	57,286	57,771	58,316	58,803	59,298	59,788	60,297	60,810	61,331	61,847

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:		
	1/4	1/5	1/6	1/7	1/9	1/11	1/13
Anne Arundel	25,629	25,781	26,130	26,478	27,082 (5,416) [1,300] {650}	27,712 (5,542) [1,330] {665}	28,352 (5,670) [1,361] {680}
Baltimore City	32,503	32,689	32,982	33,215	33,708 (6,742) [1,618] {809}	34,222 (6,844) [1,643] {821}	34,755 (6,951) [1,668] {834}
Baltimore County	39,851	40,026	40,428	40,759	41,380 (8,276) [1,986] {993}	42,035 (8,407) [2,018] {1,009}	42,701 (8,540) [2,050] {1,025}
Charles	6,328	6,396	6,471	6,534	6,659 (1,332) [320] {160}	6,788 (1,358) [326] {163}	6,918 (1,384) [332] {166}
Frederick	12,190	12,309	12,446	12,592	12,925 (2,585) [620] {310}	13,266 (2,653) [637] {318}	13,617 (2,723) [654] {327}
Harford	8,957	9,005	9,116	9,195	9,382 (1,876) [450] {225}	9,575 (1,915) [460] {230}	9,775 (1,955) [469] {235}
Howard	11,657	11,744	11,885	12,029	12,274 (2,455) [589] {295}	12,528 (2,506) [601] {301}	12,794 (2,559) [614] {307}
Montgomery	48,351	48,864	49,257	49,806	50,745 (10,149) [2,436] {1,218}	51,718 (10,344) [2,482] {1,241}	52,728 (10,546) [2,531] {1,265}
Prince George's	56,813	57,286	57,771	58,316	59,298 (11,860) [2,846] {1,423}	60,297 (12,059) [2,894] {1,447}	61,331 (12,266) [2,944] {1,472}

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.