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

Date: 1/22/21

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 1/22/21 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.

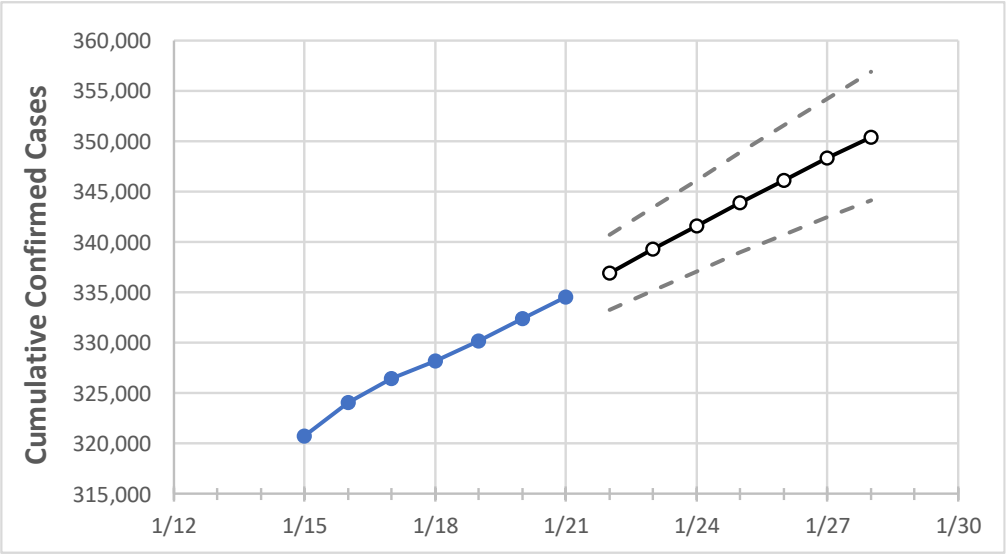
IEM's Modeling Lead

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Maryland	328,214	330,186	332,353	334,519	336,907	339,289	341,622	343,865	346,126	348,288	350,406

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Anne Arundel	30,174	30,355	30,616	30,847	31,122	31,389	31,649	31,906	32,157	32,406	32,647
Baltimore City	35,773	35,941	36,055	36,283	36,483	36,683	36,879	37,074	37,270	37,457	37,642
Baltimore County	44,207	44,391	44,639	44,944	45,214	45,480	45,752	46,016	46,285	46,545	46,806
Charles	7,264	7,303	7,346	7,412	7,473	7,532	7,592	7,654	7,711	7,772	7,834
Frederick	14,325	14,447	14,574	14,693	14,828	14,961	15,092	15,218	15,347	15,473	15,599
Harford	10,314	10,396	10,476	10,541	10,633	10,727	10,818	10,908	11,001	11,094	11,186
Howard	13,525	13,592	13,657	13,744	13,851	13,957	14,062	14,166	14,270	14,373	14,473
Montgomery	54,525	54,835	55,203	55,531	55,882	56,223	56,559	56,890	57,219	57,547	57,874
Prince George's	63,316	63,650	64,053	64,414	64,772	65,129	65,466	65,793	66,124	66,436	66,745

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:		
	1/18	1/19	1/20	1/21	1/23	1/25	1/27
Anne Arundel	30,174	30,355	30,616	30,847	31,389 (6,278) [1,507] {753}	31,906 (6,381) [1,532] {766}	32,406 (6,481) [1,555] {778}
Baltimore City	35,773	35,941	36,055	36,283	36,683 (7,337) [1,761] {880}	37,074 (7,415) [1,780] {890}	37,457 (7,491) [1,798] {899}
Baltimore County	44,207	44,391	44,639	44,944	45,480 (9,096) [2,183] {1,092}	46,016 (9,203) [2,209] {1,104}	46,545 (9,309) [2,234] {1,117}
Charles	7,264	7,303	7,346	7,412	7,532 (1,506) [362] {181}	7,654 (1,531) [367] {184}	7,772 (1,554) [373] {187}
Frederick	14,325	14,447	14,574	14,693	14,961 (2,992) [718] {359}	15,218 (3,044) [730] {365}	15,473 (3,095) [743] {371}
Harford	10,314	10,396	10,476	10,541	10,727 (2,145) [515] {257}	10,908 (2,182) [524] {262}	11,094 (2,219) [533] {266}
Howard	13,525	13,592	13,657	13,744	13,957 (2,791) [670] {335}	14,166 (2,833) [680] {340}	14,373 (2,875) [690] {345}
Montgomery	54,525	54,835	55,203	55,531	56,223 (11,245) [2,699] {1,349}	56,890 (11,378) [2,731] {1,365}	57,547 (11,509) [2,762] {1,381}
Prince George's	63,316	63,650	64,053	64,414	65,129 (13,026) [3,126] {1,563}	65,793 (13,159) [3,158] {1,579}	66,436 (13,287) [3,189] {1,594}

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.