

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

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 1/21/21 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.

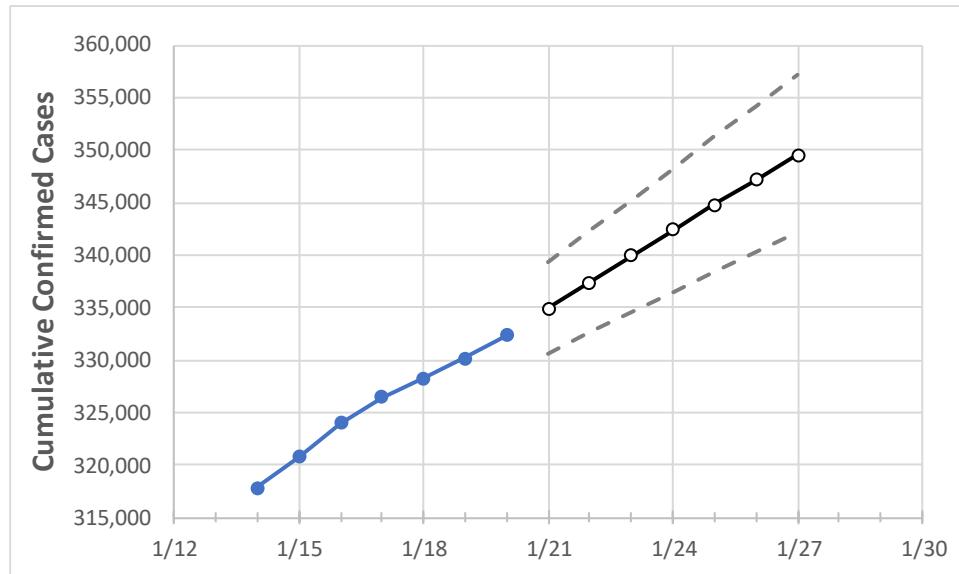
IEM's Modeling Lead

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:							
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	
Maryland	326,445	328,214	330,186	332,353	334,884	337,422	339,917	342,394	344,827	347,199	349,552	

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:							
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	
Anne Arundel	29,955	30,174	30,355	30,616	30,899	31,173	31,448	31,717	31,990	32,252	32,511	
Baltimore City	35,610	35,773	35,941	36,055	36,246	36,434	36,616	36,795	36,970	37,144	37,309	
Baltimore County	44,057	44,207	44,391	44,639	44,924	45,203	45,471	45,748	46,031	46,303	46,566	
Charles	7,235	7,264	7,303	7,346	7,406	7,464	7,521	7,579	7,638	7,695	7,752	
Frederick	14,278	14,325	14,447	14,574	14,716	14,853	14,994	15,131	15,262	15,394	15,525	
Harford	10,259	10,314	10,396	10,476	10,571	10,668	10,766	10,865	10,964	11,063	11,162	
Howard	13,433	13,525	13,592	13,657	13,771	13,886	13,997	14,113	14,226	14,338	14,451	
Montgomery	54,383	54,525	54,835	55,203	55,575	55,940	56,297	56,639	56,982	57,327	57,650	
Prince George's	62,985	63,316	63,650	64,053	64,433	64,804	65,162	65,515	65,853	66,186	66,511	

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:			
	1/17	1/18	1/19	1/20	1/22	1/24	1/26	
Anne Arundel	29,955	30,174	30,355	30,616	31,173 (6,235) [1,496] {748}	31,717 (6,343) [1,522] {761}	32,252 (6,450) [1,548] {774}	
Baltimore City	35,610	35,773	35,941	36,055	36,434 (7,287) [1,749] {874}	36,795 (7,359) [1,766] {883}	37,144 (7,429) [1,783] {891}	
Baltimore County	44,057	44,207	44,391	44,639	45,203 (9,041) [2,170] {1,085}	45,748 (9,150) [2,196] {1,098}	46,303 (9,261) [2,223] {1,111}	
Charles	7,235	7,264	7,303	7,346	7,464 (1,493) [358] {179}	7,579 (1,516) [364] {182}	7,695 (1,539) [369] {185}	
Frederick	14,278	14,325	14,447	14,574	14,853 (2,971) [713] {356}	15,131 (3,026) [726] {363}	15,394 (3,079) [739] {369}	
Harford	10,259	10,314	10,396	10,476	10,668 (2,134) [512] {256}	10,865 (2,173) [522] {261}	11,063 (2,213) [531] {266}	
Howard	13,433	13,525	13,592	13,657	13,886 (2,777) [667] {333}	14,113 (2,823) [677] {339}	14,338 (2,868) [688] {344}	
Montgomery	54,383	54,525	54,835	55,203	55,940 (11,188) [2,685] {1,343}	56,639 (11,328) [2,719] {1,359}	57,327 (11,465) [2,752] {1,376}	
Prince George's	62,985	63,316	63,650	64,053	64,804 (12,961) [3,111] {1,555}	65,515 (13,103) [3,145] {1,572}	66,186 (13,237) [3,177] {1,588}	

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.