

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

Date: 4/7/21

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 4/7/21 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.

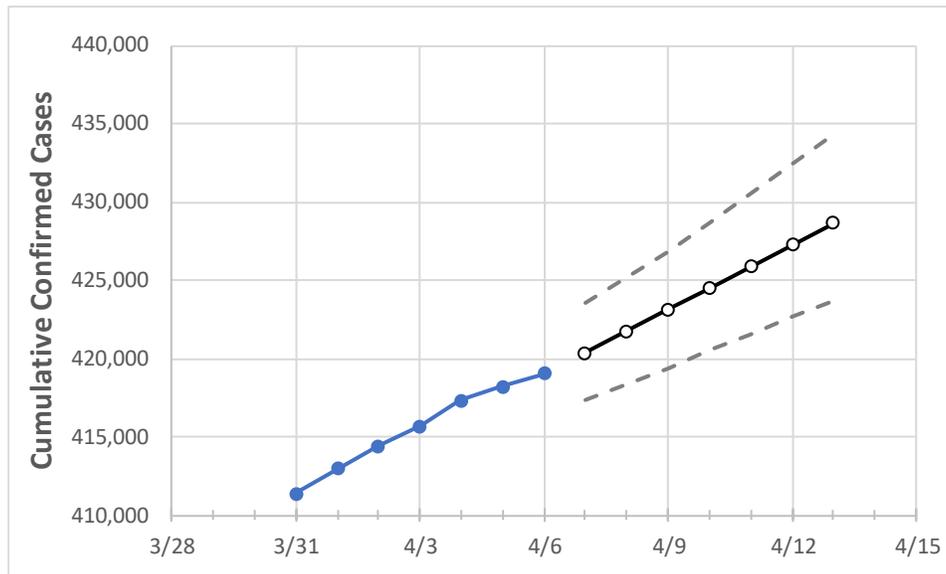
IEM's Modeling Lead

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:							
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	
Maryland	415,660	417,329	418,188	419,055	420,388	421,746	423,117	424,497	425,863	427,250	428,641	

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:							
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	
Anne Arundel	39,345	39,483	39,578	39,658	39,790	39,924	40,059	40,196	40,331	40,467	40,603	
Baltimore City	45,318	45,660	45,825	45,967	46,216	46,469	46,726	46,990	47,258	47,531	47,809	
Baltimore County	56,735	57,083	57,222	57,383	57,654	57,926	58,208	58,495	58,788	59,091	59,397	
Charles	9,872	9,895	9,906	9,937	9,967	9,997	10,027	10,058	10,089	10,120	10,151	
Frederick	18,384	18,425	18,479	18,507	18,555	18,605	18,654	18,704	18,754	18,804	18,854	
Harford	14,330	14,437	14,490	14,553	14,649	14,747	14,845	14,947	15,049	15,157	15,266	
Howard	17,470	17,567	17,605	17,641	17,706	17,772	17,840	17,908	17,978	18,048	18,116	
Montgomery	67,212	67,303	67,375	67,505	67,624	67,745	67,865	67,985	68,104	68,223	68,342	
Prince George’s	78,840	78,948	79,087	79,286	79,473	79,662	79,850	80,040	80,228	80,419	80,615	

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:											
	4/3	4/4	4/5	4/6	4/8			4/10			4/12					
Anne Arundel	39,345	39,483	39,578	39,658	39,924	(7,985)	[1,916]	{958}	40,196	(8,039)	[1,929]	{965}	40,467	(8,093)	[1,942]	{971}
Baltimore City	45,318	45,660	45,825	45,967	46,469	(9,294)	[2,230]	{1,115}	46,990	(9,398)	[2,256]	{1,128}	47,531	(9,506)	[2,281]	{1,141}
Baltimore County	56,735	57,083	57,222	57,383	57,926	(11,585)	[2,780]	{1,390}	58,495	(11,699)	[2,808]	{1,404}	59,091	(11,818)	[2,836]	{1,418}
Charles	9,872	9,895	9,906	9,937	9,997	(1,999)	[480]	{240}	10,058	(2,012)	[483]	{241}	10,120	(2,024)	[486]	{243}
Frederick	18,384	18,425	18,479	18,507	18,605	(3,721)	[893]	{447}	18,704	(3,741)	[898]	{449}	18,804	(3,761)	[903]	{451}
Harford	14,330	14,437	14,490	14,553	14,747	(2,949)	[708]	{354}	14,947	(2,989)	[717]	{359}	15,157	(3,031)	[728]	{364}
Howard	17,470	17,567	17,605	17,641	17,772	(3,554)	[853]	{427}	17,908	(3,582)	[860]	{430}	18,048	(3,610)	[866]	{433}
Montgomery	67,212	67,303	67,375	67,505	67,745	(13,549)	[3,252]	{1,626}	67,985	(13,597)	[3,263]	{1,632}	68,223	(13,645)	[3,275]	{1,637}
Prince George's	78,840	78,948	79,087	79,286	79,662	(15,932)	[3,824]	{1,912}	80,040	(16,008)	[3,842]	{1,921}	80,419	(16,084)	[3,860]	{1,930}

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.