

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

Date: 5/7/21

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 5/7/21 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.

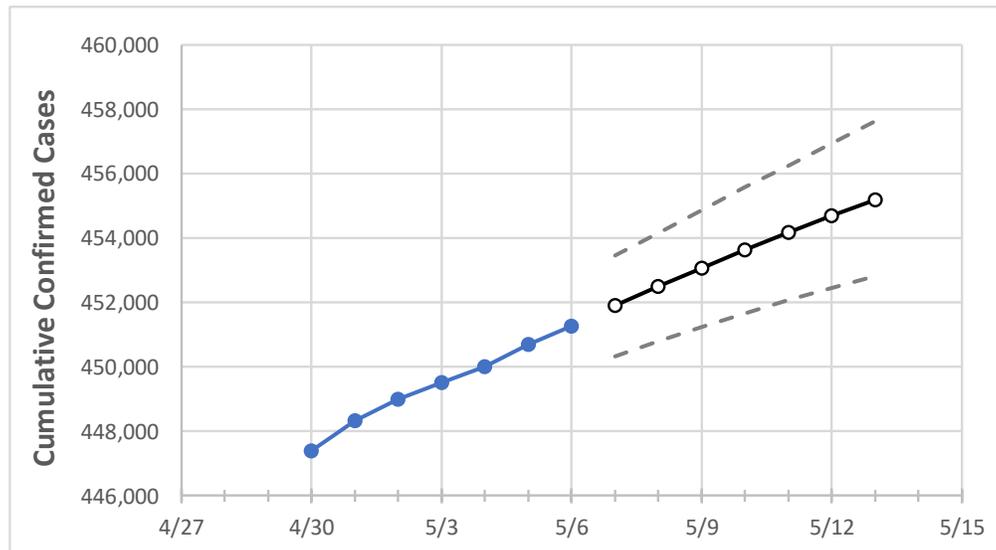
IEM's Modeling Lead

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:							
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	
Maryland	449,509	450,010	450,689	451,267	451,894	452,492	453,069	453,641	454,165	454,686	455,182	

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:							
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	
Anne Arundel	42,709	42,756	42,834	42,886	42,946	43,004	43,060	43,112	43,164	43,213	43,262	
Baltimore City	51,306	51,380	51,488	51,579	51,677	51,769	51,861	51,952	52,035	52,113	52,190	
Baltimore County	63,835	63,940	64,086	64,193	64,318	64,436	64,551	64,659	64,764	64,864	64,962	
Charles	10,593	10,609	10,626	10,642	10,658	10,674	10,689	10,704	10,719	10,733	10,747	
Frederick	19,481	19,504	19,518	19,540	19,554	19,568	19,582	19,594	19,606	19,617	19,628	
Harford	16,151	16,164	16,185	16,207	16,229	16,249	16,268	16,287	16,304	16,321	16,337	
Howard	18,922	18,940	18,961	18,985	19,009	19,032	19,053	19,074	19,094	19,113	19,132	
Montgomery	70,006	70,075	70,089	70,154	70,203	70,251	70,297	70,342	70,387	70,430	70,468	
Prince George's	83,410	83,504	83,598	83,714	83,815	83,912	84,007	84,100	84,193	84,283	84,369	

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:											
	5/3	5/4	5/5	5/6	5/8			5/10			5/12					
Anne Arundel	42,709	42,756	42,834	42,886	43,004	(8,601)	[2,064]	{1,032}	43,112	(8,622)	[2,069]	{1,035}	43,213	(8,643)	[2,074]	{1,037}
Baltimore City	51,306	51,380	51,488	51,579	51,769	(10,354)	[2,485]	{1,242}	51,952	(10,390)	[2,494]	{1,247}	52,113	(10,423)	[2,501]	{1,251}
Baltimore County	63,835	63,940	64,086	64,193	64,436	(12,887)	[3,093]	{1,546}	64,659	(12,932)	[3,104]	{1,552}	64,864	(12,973)	[3,113]	{1,557}
Charles	10,593	10,609	10,626	10,642	10,674	(2,135)	[512]	{256}	10,704	(2,141)	[514]	{257}	10,733	(2,147)	[515]	{258}
Frederick	19,481	19,504	19,518	19,540	19,568	(3,914)	[939]	{470}	19,594	(3,919)	[941]	{470}	19,617	(3,923)	[942]	{471}
Harford	16,151	16,164	16,185	16,207	16,249	(3,250)	[780]	{390}	16,287	(3,257)	[782]	{391}	16,321	(3,264)	[783]	{392}
Howard	18,922	18,940	18,961	18,985	19,032	(3,806)	[914]	{457}	19,074	(3,815)	[916]	{458}	19,113	(3,823)	[917]	{459}
Montgomery	70,006	70,075	70,089	70,154	70,251	(14,050)	[3,372]	{1,686}	70,342	(14,068)	[3,376]	{1,688}	70,430	(14,086)	[3,381]	{1,690}
Prince George's	83,410	83,504	83,598	83,714	83,912	(16,782)	[4,028]	{2,014}	84,100	(16,820)	[4,037]	{2,018}	84,283	(16,857)	[4,046]	{2,023}

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.