

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

Date: 4/26/21

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 4/26/21 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.

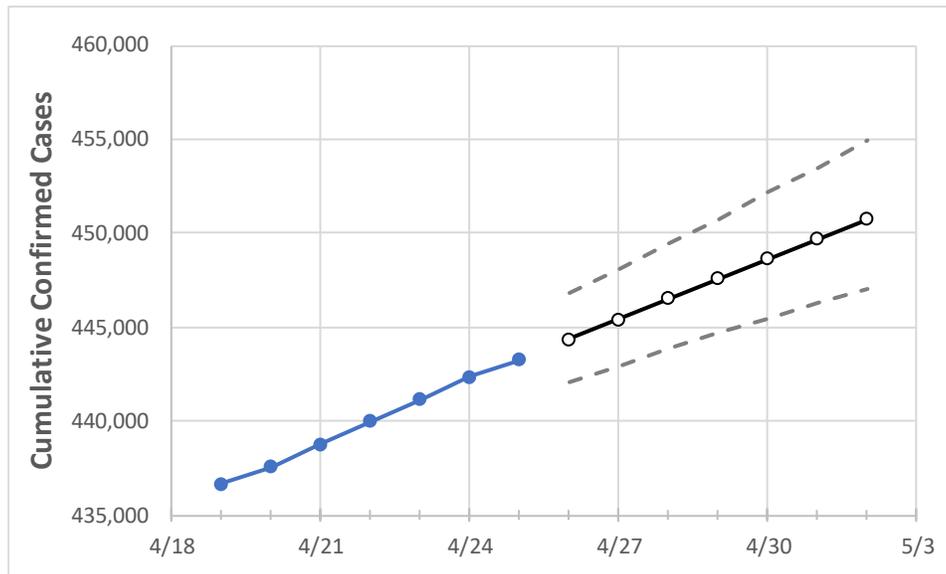
IEM's Modeling Lead

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:					
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	
Maryland	439,992	441,155	442,351	443,257	444,360	445,441	446,511	447,592	448,655	449,706	450,751	

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:							
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	
Anne Arundel	41,743	41,852	42,014	42,103	42,220	42,337	42,457	42,573	42,689	42,805	42,922	
Baltimore City	49,767	49,950	50,147	50,311	50,508	50,701	50,889	51,076	51,266	51,449	51,628	
Baltimore County	61,847	62,136	62,391	62,566	62,817	63,066	63,311	63,559	63,807	64,055	64,298	
Charles	10,377	10,407	10,423	10,435	10,456	10,477	10,498	10,518	10,537	10,557	10,576	
Frederick	19,244	19,282	19,304	19,323	19,353	19,381	19,409	19,435	19,461	19,486	19,510	
Harford	15,754	15,811	15,872	15,913	15,969	16,021	16,073	16,125	16,176	16,226	16,274	
Howard	18,556	18,600	18,638	18,683	18,732	18,778	18,824	18,871	18,917	18,964	19,009	
Montgomery	69,238	69,334	69,420	69,476	69,557	69,636	69,714	69,790	69,864	69,938	70,011	
Prince George's	82,029	82,190	82,316	82,405	82,544	82,679	82,814	82,946	83,074	83,200	83,324	

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:											
	4/22	4/23	4/24	4/25	4/27				4/29				5/1			
Anne Arundel	41,743	41,852	42,014	42,103	42,337	(8,467)	[2,032]	{1,016}	42,573	(8,515)	[2,043]	{1,022}	42,805	(8,561)	[2,055]	{1,027}
Baltimore City	49,767	49,950	50,147	50,311	50,701	(10,140)	[2,434]	{1,217}	51,076	(10,215)	[2,452]	{1,226}	51,449	(10,290)	[2,470]	{1,235}
Baltimore County	61,847	62,136	62,391	62,566	63,066	(12,613)	[3,027]	{1,514}	63,559	(12,712)	[3,051]	{1,525}	64,055	(12,811)	[3,075]	{1,537}
Charles	10,377	10,407	10,423	10,435	10,477	(2,095)	[503]	{251}	10,518	(2,104)	[505]	{252}	10,557	(2,111)	[507]	{253}
Frederick	19,244	19,282	19,304	19,323	19,381	(3,876)	[930]	{465}	19,435	(3,887)	[933]	{466}	19,486	(3,897)	[935]	{468}
Harford	15,754	15,811	15,872	15,913	16,021	(3,204)	[769]	{385}	16,125	(3,225)	[774]	{387}	16,226	(3,245)	[779]	{389}
Howard	18,556	18,600	18,638	18,683	18,778	(3,756)	[901]	{451}	18,871	(3,774)	[906]	{453}	18,964	(3,793)	[910]	{455}
Montgomery	69,238	69,334	69,420	69,476	69,636	(13,927)	[3,343]	{1,671}	69,790	(13,958)	[3,350]	{1,675}	69,938	(13,988)	[3,357]	{1,679}
Prince George's	82,029	82,190	82,316	82,405	82,679	(16,536)	[3,969]	{1,984}	82,946	(16,589)	[3,981]	{1,991}	83,200	(16,640)	[3,994]	{1,997}

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.