

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

Date: 1/31/22

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 1/31/22 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.

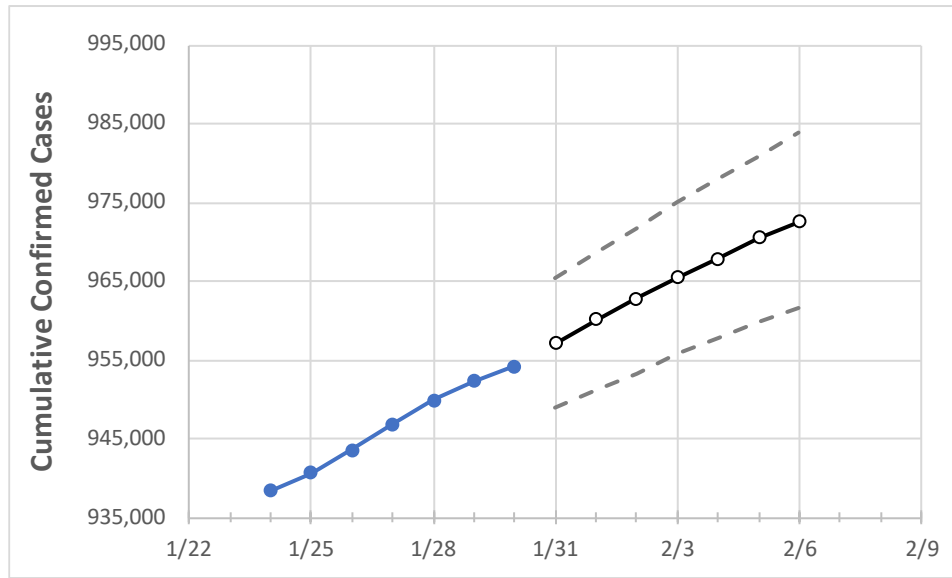
IEM's Modeling Lead

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:							
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	
Maryland	946,869	949,880	952,271	954,212	957,135	960,097	962,868	965,406	967,934	970,478	972,619	

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:							
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	
Anne Arundel	83,673	83,942	84,156	84,303	84,555	84,802	85,040	85,266	85,486	85,704	85,917	
Baltimore City	104,531	104,765	104,985	105,141	105,373	105,574	105,777	105,973	106,166	106,346	106,503	
Baltimore County	124,032	124,336	124,577	124,791	125,084	125,367	125,611	125,872	126,097	126,341	126,554	
Charles	26,076	26,144	26,144	26,144	26,246	26,341	26,433	26,529	26,610	26,696	26,777	
Frederick	42,423	42,549	42,549	42,549	42,670	42,791	42,904	43,019	43,124	43,223	43,318	
Harford	35,646	35,779	35,897	35,957	36,063	36,167	36,259	36,355	36,446	36,531	36,613	
Howard	40,205	40,380	40,482	40,597	40,744	40,885	41,007	41,144	41,263	41,396	41,510	
Montgomery	156,593	156,930	156,930	156,930	157,473	158,000	158,500	158,947	159,421	159,857	160,261	
Prince George’s	161,293	161,498	161,498	161,498	161,839	162,191	162,477	162,781	163,074	163,368	163,601	

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:											
	1/27	1/28	1/29	1/30	2/1			2/3			2/5					
Anne Arundel	83,673	83,942	84,156	84,303	84,802	(16,960)	[4,071]	{2,035}	85,266	(17,053)	[4,093]	{2,046}	85,704	(17,141)	[4,114]	{2,057}
Baltimore City	104,531	104,765	104,985	105,141	105,574	(21,115)	[5,068]	{2,534}	105,973	(21,195)	[5,087]	{2,543}	106,346	(21,269)	[5,105]	{2,552}
Baltimore County	124,032	124,336	124,577	124,791	125,367	(25,073)	[6,018]	{3,009}	125,872	(25,174)	[6,042]	{3,021}	126,341	(25,268)	[6,064]	{3,032}
Charles	26,076	26,144	26,144	26,144	26,341	(5,268)	[1,264]	{632}	26,529	(5,306)	[1,273]	{637}	26,696	(5,339)	[1,281]	{641}
Frederick	42,423	42,549	42,549	42,549	42,791	(8,558)	[2,054]	{1,027}	43,019	(8,604)	[2,065]	{1,032}	43,223	(8,645)	[2,075]	{1,037}
Harford	35,646	35,779	35,897	35,957	36,167	(7,233)	[1,736]	{868}	36,355	(7,271)	[1,745]	{873}	36,531	(7,306)	[1,753]	{877}
Howard	40,205	40,380	40,482	40,597	40,885	(8,177)	[1,962]	{981}	41,144	(8,229)	[1,975]	{987}	41,396	(8,279)	[1,987]	{993}
Montgomery	156,593	156,930	156,930	156,930	158,000	(31,600)	[7,584]	{3,792}	158,947	(31,789)	[7,629]	{3,815}	159,857	(31,971)	[7,673]	{3,837}
Prince George's	161,293	161,498	161,498	161,498	162,191	(32,438)	[7,785]	{3,893}	162,781	(32,556)	[7,813]	{3,907}	163,368	(32,674)	[7,842]	{3,921}

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.