

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/31/20**

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 12/31/20 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.

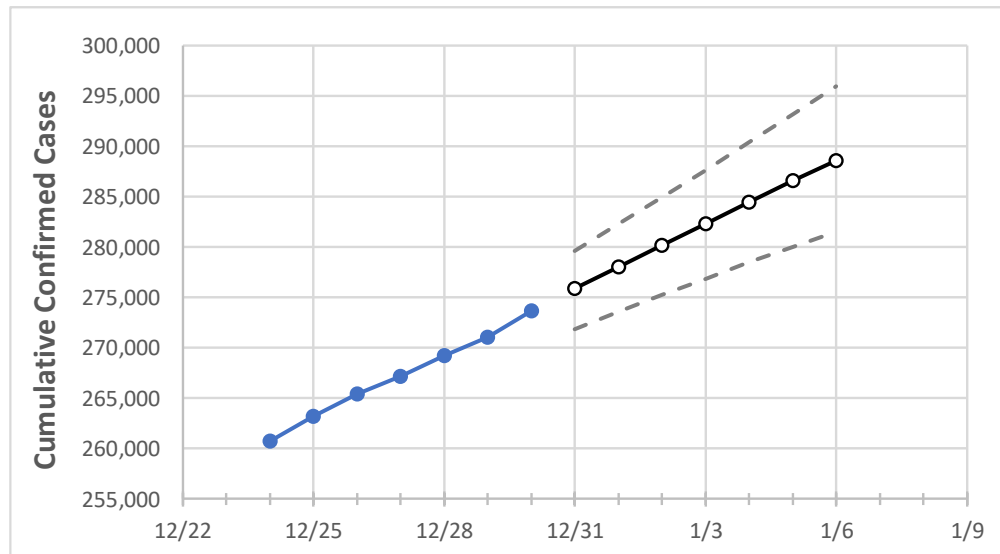
IEM's Modeling Lead

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:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Maryland	267,198	269,183	271,061	273,689	275,870	278,012	280,174	282,266	284,437	286,544	288,600

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 20%, and are often within 10%, of actual confirmed cases.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Anne Arundel	23,408	23,634	23,789	24,045	24,268	24,488	24,708	24,930	25,149	25,371	25,588
Baltimore City	30,777	30,989	31,123	31,312	31,487	31,657	31,828	31,998	32,168	32,335	32,501
Baltimore County	37,549	37,799	37,971	38,280	38,508	38,731	38,951	39,169	39,377	39,592	39,804
Charles	5,892	5,922	5,987	6,036	6,085	6,132	6,178	6,223	6,269	6,315	6,361
Frederick	10,788	10,891	11,100	11,301	11,452	11,607	11,760	11,918	12,074	12,239	12,395
Harford	8,253	8,323	8,371	8,475	8,544	8,612	8,679	8,745	8,812	8,877	8,941
Howard	10,822	10,898	10,986	11,088	11,170	11,252	11,334	11,417	11,501	11,583	11,663
Montgomery	45,050	45,341	45,791	46,200	46,589	46,972	47,358	47,747	48,135	48,520	48,911
Prince George's	53,338	53,692	54,127	54,581	54,916	55,250	55,588	55,919	56,238	56,563	56,876

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:											
	12/27	12/28	12/29	12/30	1/1				1/3				1/5			
Anne Arundel	23,408	23,634	23,789	24,045	24,488	(4,898)	[1,175]	{588}	24,930	(4,986)	[1,197]	{598}	25,371	(5,074)	[1,218]	{609}
Baltimore City	30,777	30,989	31,123	31,312	31,657	(6,331)	[1,520]	{760}	31,998	(6,400)	[1,536]	{768}	32,335	(6,467)	[1,552]	{776}
Baltimore County	37,549	37,799	37,971	38,280	38,731	(7,746)	[1,859]	{930}	39,169	(7,834)	[1,880]	{940}	39,592	(7,918)	[1,900]	{950}
Charles	5,892	5,922	5,987	6,036	6,132	(1,226)	[294]	{147}	6,223	(1,245)	[299]	{149}	6,315	(1,263)	[303]	{152}
Frederick	10,788	10,891	11,100	11,301	11,607	(2,321)	[557]	{279}	11,918	(2,384)	[572]	{286}	12,239	(2,448)	[587]	{294}
Harford	8,253	8,323	8,371	8,475	8,612	(1,722)	[413]	{207}	8,745	(1,749)	[420]	{210}	8,877	(1,775)	[426]	{213}
Howard	10,822	10,898	10,986	11,088	11,252	(2,250)	[540]	{270}	11,417	(2,283)	[548]	{274}	11,583	(2,317)	[556]	{278}
Montgomery	45,050	45,341	45,791	46,200	46,972	(9,394)	[2,255]	{1,127}	47,747	(9,549)	[2,292]	{1,146}	48,520	(9,704)	[2,329]	{1,164}
Prince George's	53,338	53,692	54,127	54,581	55,250	(11,050)	[2,652]	{1,326}	55,919	(11,184)	[2,684]	{1,342}	56,563	(11,313)	[2,715]	{1,358}

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.