

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/20/21**

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 1/20/21 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.

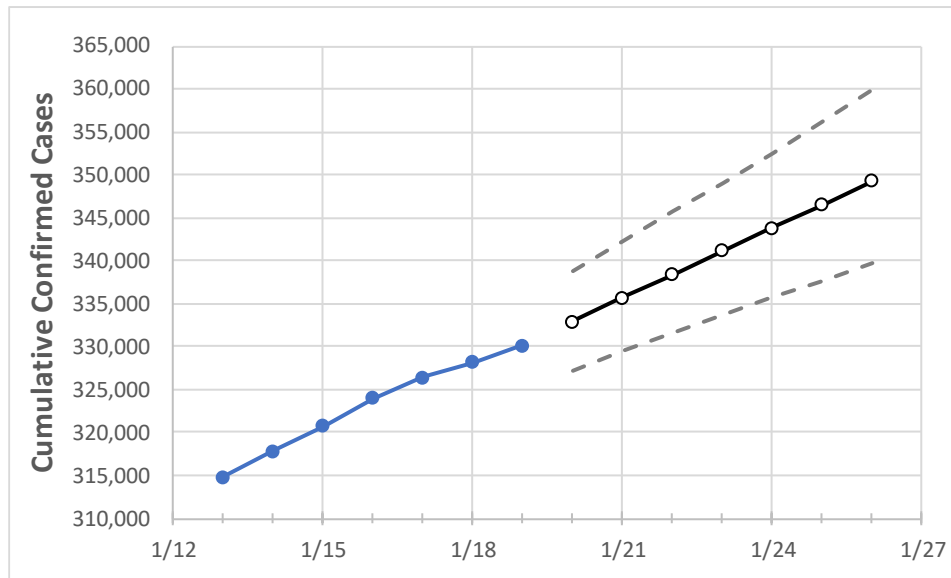
IEM's Modeling Lead

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:							
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	
Maryland	324,031	326,445	328,214	330,186	332,932	335,667	338,370	341,125	343,841	346,569	349,275	

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:							
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	
Anne Arundel	29,710	29,955	30,174	30,355	30,671	30,982	31,289	31,599	31,915	32,214	32,530	
Baltimore City	35,405	35,610	35,773	35,941	36,154	36,361	36,566	36,765	36,966	37,161	37,357	
Baltimore County	43,793	44,057	44,207	44,391	44,680	44,970	45,264	45,559	45,851	46,133	46,425	
Charles	7,206	7,235	7,264	7,303	7,367	7,428	7,492	7,555	7,619	7,683	7,748	
Frederick	14,230	14,278	14,325	14,447	14,591	14,734	14,882	15,017	15,157	15,301	15,439	
Harford	10,160	10,259	10,314	10,396	10,494	10,593	10,693	10,792	10,895	10,999	11,099	
Howard	13,330	13,433	13,525	13,592	13,719	13,844	13,972	14,098	14,225	14,355	14,488	
Montgomery	54,241	54,383	54,525	54,835	55,209	55,579	55,945	56,297	56,638	56,976	57,310	
Prince George's	62,927	62,985	63,316	63,650	64,039	64,415	64,794	65,156	65,514	65,870	66,209	

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:											
	1/16	1/17	1/18	1/19	1/21				1/23				1/25			
Anne Arundel	29,710	29,955	30,174	30,355	30,982	(6,196)	[1,487]	{744}	31,599	(6,320)	[1,517]	{758}	32,214	(6,443)	[1,546]	{773}
Baltimore City	35,405	35,610	35,773	35,941	36,361	(7,272)	[1,745]	{873}	36,765	(7,353)	[1,765]	{882}	37,161	(7,432)	[1,784]	{892}
Baltimore County	43,793	44,057	44,207	44,391	44,970	(8,994)	[2,159]	{1,079}	45,559	(9,112)	[2,187]	{1,093}	46,133	(9,227)	[2,214]	{1,107}
Charles	7,206	7,235	7,264	7,303	7,428	(1,486)	[357]	{178}	7,555	(1,511)	[363]	{181}	7,683	(1,537)	[369]	{184}
Frederick	14,230	14,278	14,325	14,447	14,734	(2,947)	[707]	{354}	15,017	(3,003)	[721]	{360}	15,301	(3,060)	[734]	{367}
Harford	10,160	10,259	10,314	10,396	10,593	(2,119)	[508]	{254}	10,792	(2,158)	[518]	{259}	10,999	(2,200)	[528]	{264}
Howard	13,330	13,433	13,525	13,592	13,844	(2,769)	[665]	{332}	14,098	(2,820)	[677]	{338}	14,355	(2,871)	[689]	{345}
Montgomery	54,241	54,383	54,525	54,835	55,579	(11,116)	[2,668]	{1,334}	56,297	(11,259)	[2,702]	{1,351}	56,976	(11,395)	[2,735]	{1,367}
Prince George's	62,927	62,985	63,316	63,650	64,415	(12,883)	[3,092]	{1,546}	65,156	(13,031)	[3,127]	{1,564}	65,870	(13,174)	[3,162]	{1,581}

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.