

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/23/21**

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 2/23/21 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.

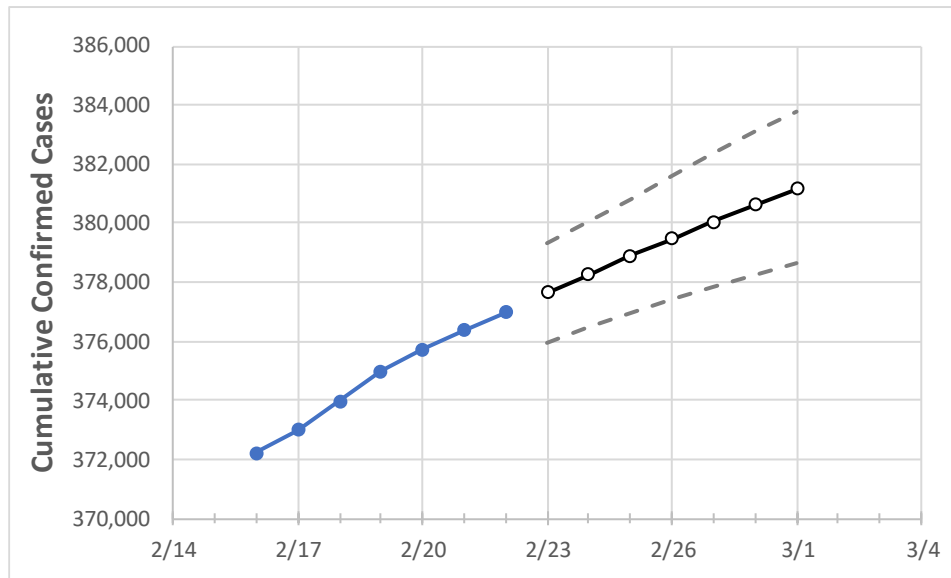
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Maryland	374,974	375,737	376,355	376,966	377,644	378,272	378,885	379,480	380,055	380,615	381,155

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Anne Arundel	34,964	35,040	35,094	35,166	35,236	35,302	35,367	35,431	35,492	35,549	35,609
Baltimore City	39,701	39,785	39,839	39,899	39,956	40,012	40,065	40,115	40,163	40,210	40,255
Baltimore County	49,897	49,977	50,063	50,132	50,216	50,297	50,372	50,446	50,518	50,586	50,654
Charles	8,714	8,733	8,751	8,771	8,790	8,809	8,827	8,845	8,861	8,877	8,893
Frederick	16,659	16,691	16,715	16,747	16,778	16,809	16,838	16,868	16,896	16,922	16,947
Harford	12,212	12,262	12,285	12,309	12,340	12,370	12,399	12,427	12,455	12,481	12,506
Howard	15,461	15,505	15,519	15,568	15,602	15,634	15,665	15,696	15,726	15,754	15,782
Montgomery	62,336	62,436	62,523	62,626	62,715	62,801	62,881	62,961	63,037	63,108	63,177
Prince George's	71,993	72,122	72,250	72,416	72,551	72,682	72,811	72,937	73,058	73,176	73,288

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Anne Arundel	34,964	35,040	35,094	35,166	35,302	(7,060)	[1,694]	{847}	35,431	(7,086)	[1,701]	{850}	35,549	(7,110)	[1,706]	{853}
Baltimore City	39,701	39,785	39,839	39,899	40,012	(8,002)	[1,921]	{960}	40,115	(8,023)	[1,926]	{963}	40,210	(8,042)	[1,930]	{965}
Baltimore County	49,897	49,977	50,063	50,132	50,297	(10,059)	[2,414]	{1,207}	50,446	(10,089)	[2,421]	{1,211}	50,586	(10,117)	[2,428]	{1,214}
Charles	8,714	8,733	8,751	8,771	8,809	(1,762)	[423]	{211}	8,845	(1,769)	[425]	{212}	8,877	(1,775)	[426]	{213}
Frederick	16,659	16,691	16,715	16,747	16,809	(3,362)	[807]	{403}	16,868	(3,374)	[810]	{405}	16,922	(3,384)	[812]	{406}
Harford	12,212	12,262	12,285	12,309	12,370	(2,474)	[594]	{297}	12,427	(2,485)	[597]	{298}	12,481	(2,496)	[599]	{300}
Howard	15,461	15,505	15,519	15,568	15,634	(3,127)	[750]	{375}	15,696	(3,139)	[753]	{377}	15,754	(3,151)	[756]	{378}
Montgomery	62,336	62,436	62,523	62,626	62,801	(12,560)	[3,014]	{1,507}	62,961	(12,592)	[3,022]	{1,511}	63,108	(12,622)	[3,029]	{1,515}
Prince George's	71,993	72,122	72,250	72,416	72,682	(14,536)	[3,489]	{1,744}	72,937	(14,587)	[3,501]	{1,750}	73,176	(14,635)	[3,512]	{1,756}

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.