

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

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 2/19/21 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.

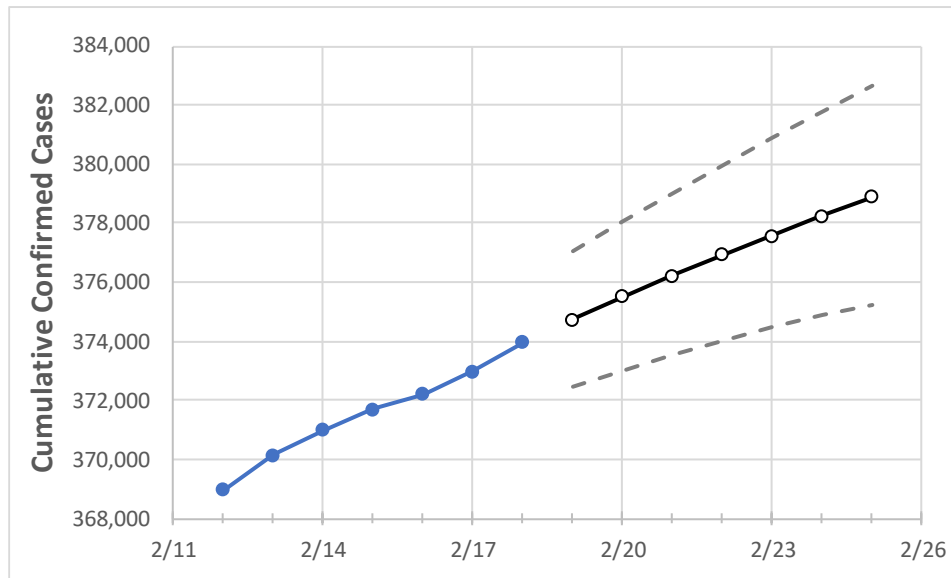
IEM's Modeling Lead

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Maryland	371,705	372,221	372,980	373,966	374,742	375,501	376,227	376,936	377,590	378,248	378,893

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Anne Arundel	34,602	34,645	34,721	34,860	34,939	35,018	35,093	35,163	35,231	35,300	35,367
Baltimore City	39,497	39,552	39,560	39,633	39,703	39,770	39,837	39,899	39,960	40,020	40,077
Baltimore County	49,444	49,497	49,653	49,762	49,861	49,957	50,049	50,139	50,223	50,307	50,386
Charles	8,597	8,626	8,656	8,656	8,678	8,698	8,718	8,737	8,756	8,774	8,791
Frederick	16,481	16,511	16,582	16,582	16,619	16,656	16,690	16,722	16,754	16,784	16,813
Harford	12,080	12,095	12,129	12,168	12,204	12,238	12,271	12,303	12,334	12,365	12,395
Howard	15,316	15,342	15,384	15,425	15,463	15,500	15,536	15,570	15,604	15,638	15,669
Montgomery	61,835	61,942	62,085	62,085	62,188	62,287	62,381	62,471	62,556	62,637	62,716
Prince George's	71,216	71,402	71,586	71,586	71,727	71,861	71,990	72,113	72,234	72,344	72,454

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:											
	2/15	2/16	2/17	2/18	2/20				2/22				2/24			
Anne Arundel	34,602	34,645	34,721	34,860	35,018	(7,004)	[1,681]	{840}	35,163	(7,033)	[1,688]	{844}	35,300	(7,060)	[1,694]	{847}
Baltimore City	39,497	39,552	39,560	39,633	39,770	(7,954)	[1,909]	{954}	39,899	(7,980)	[1,915]	{958}	40,020	(8,004)	[1,921]	{960}
Baltimore County	49,444	49,497	49,653	49,762	49,957	(9,991)	[2,398]	{1,199}	50,139	(10,028)	[2,407]	{1,203}	50,307	(10,061)	[2,415]	{1,207}
Charles	8,597	8,626	8,656	8,656	8,698	(1,740)	[418]	{209}	8,737	(1,747)	[419]	{210}	8,774	(1,755)	[421]	{211}
Frederick	16,481	16,511	16,582	16,582	16,656	(3,331)	[799]	{400}	16,722	(3,344)	[803]	{401}	16,784	(3,357)	[806]	{403}
Harford	12,080	12,095	12,129	12,168	12,238	(2,448)	[587]	{294}	12,303	(2,461)	[591]	{295}	12,365	(2,473)	[594]	{297}
Howard	15,316	15,342	15,384	15,425	15,500	(3,100)	[744]	{372}	15,570	(3,114)	[747]	{374}	15,638	(3,128)	[751]	{375}
Montgomery	61,835	61,942	62,085	62,085	62,287	(12,457)	[2,990]	{1,495}	62,471	(12,494)	[2,999]	{1,499}	62,637	(12,527)	[3,007]	{1,503}
Prince George's	71,216	71,402	71,586	71,586	71,861	(14,372)	[3,449]	{1,725}	72,113	(14,423)	[3,461]	{1,731}	72,344	(14,469)	[3,473]	{1,736}

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.