

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 4/22/21**

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 4/22/21 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.

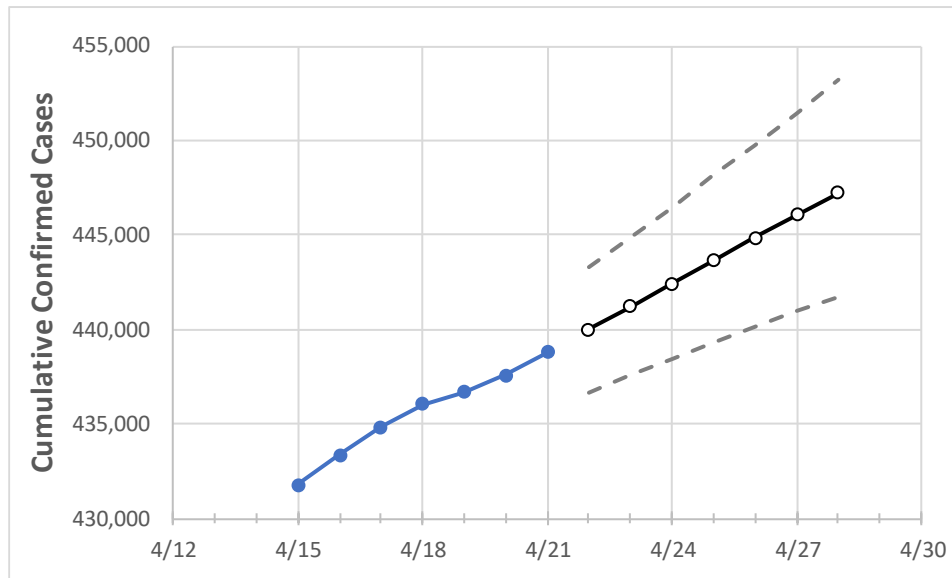
IEM's Modeling Lead

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Maryland	436,028	436,659	437,584	438,789	440,021	441,232	442,445	443,656	444,855	446,066	447,238	

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Anne Arundel	41,312	41,386	41,463	41,610	41,738	41,867	41,997	42,125	42,250	42,376	42,499	
Baltimore City	49,104	49,255	49,409	49,592	49,816	50,037	50,256	50,477	50,694	50,914	51,135	
Baltimore County	60,935	61,095	61,278	61,567	61,838	62,113	62,384	62,659	62,938	63,210	63,483	
Charles	10,284	10,296	10,328	10,359	10,384	10,410	10,435	10,459	10,484	10,508	10,533	
Frederick	19,111	19,150	19,182	19,215	19,255	19,293	19,330	19,367	19,402	19,437	19,473	
Harford	15,552	15,581	15,645	15,700	15,765	15,830	15,893	15,954	16,015	16,077	16,137	
Howard	18,385	18,406	18,454	18,497	18,551	18,602	18,651	18,702	18,752	18,802	18,854	
Montgomery	68,865	68,945	69,049	69,147	69,241	69,333	69,427	69,517	69,606	69,693	69,779	
Prince George's	81,382	81,523	81,701	81,864	82,022	82,178	82,335	82,490	82,646	82,796	82,943	

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:											
	4/18	4/19	4/20	4/21	4/23				4/25				4/27			
Anne Arundel	41,312	41,386	41,463	41,610	41,867	(8,373)	[2,010]	{1,005}	42,125	(8,425)	[2,022]	{1,011}	42,376	(8,475)	[2,034]	{1,017}
Baltimore City	49,104	49,255	49,409	49,592	50,037	(10,007)	[2,402]	{1,201}	50,477	(10,095)	[2,423]	{1,211}	50,914	(10,183)	[2,444]	{1,222}
Baltimore County	60,935	61,095	61,278	61,567	62,113	(12,423)	[2,981]	{1,491}	62,659	(12,532)	[3,008]	{1,504}	63,210	(12,642)	[3,034]	{1,517}
Charles	10,284	10,296	10,328	10,359	10,410	(2,082)	[500]	{250}	10,459	(2,092)	[502]	{251}	10,508	(2,102)	[504]	{252}
Frederick	19,111	19,150	19,182	19,215	19,293	(3,859)	[926]	{463}	19,367	(3,873)	[930]	{465}	19,437	(3,887)	[933]	{466}
Harford	15,552	15,581	15,645	15,700	15,830	(3,166)	[760]	{380}	15,954	(3,191)	[766]	{383}	16,077	(3,215)	[772]	{386}
Howard	18,385	18,406	18,454	18,497	18,602	(3,720)	[893]	{446}	18,702	(3,740)	[898]	{449}	18,802	(3,760)	[902]	{451}
Montgomery	68,865	68,945	69,049	69,147	69,333	(13,867)	[3,328]	{1,664}	69,517	(13,903)	[3,337]	{1,668}	69,693	(13,939)	[3,345]	{1,673}
Prince George's	81,382	81,523	81,701	81,864	82,178	(16,436)	[3,945]	{1,972}	82,490	(16,498)	[3,960]	{1,980}	82,796	(16,559)	[3,974]	{1,987}

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.