

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 4/27/21

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 4/27/21 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.

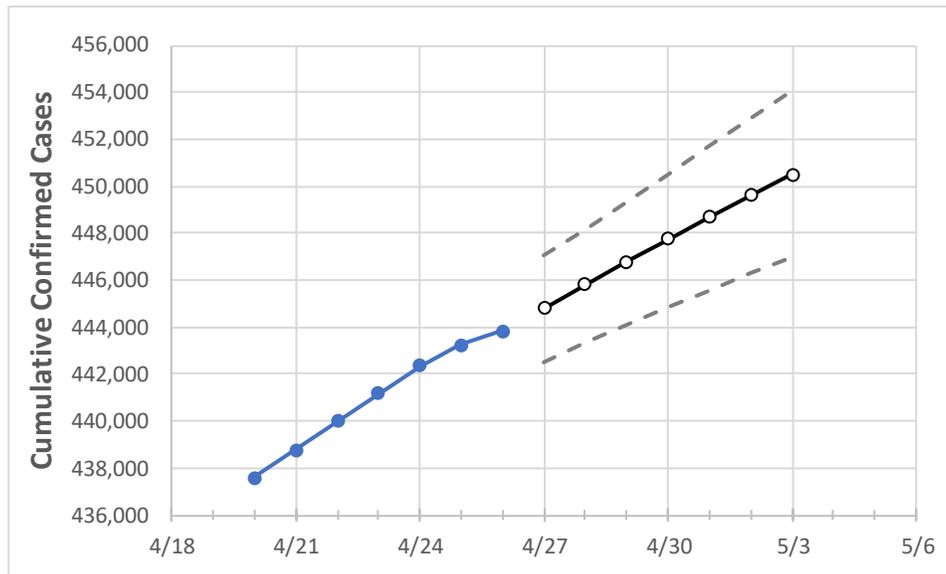
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Maryland	441,155	442,351	443,257	443,814	444,826	445,816	446,787	447,745	448,682	449,596	450,494

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Anne Arundel	41,852	42,014	42,103	42,150	42,260	42,370	42,478	42,584	42,690	42,799	42,904
Baltimore City	49,950	50,147	50,311	50,423	50,604	50,787	50,961	51,134	51,304	51,470	51,634
Baltimore County	62,136	62,391	62,566	62,652	62,883	63,118	63,335	63,560	63,779	63,998	64,212
Charles	10,407	10,423	10,435	10,435	10,456	10,477	10,499	10,519	10,540	10,559	10,579
Frederick	19,282	19,304	19,323	19,323	19,352	19,382	19,411	19,438	19,465	19,491	19,517
Harford	15,811	15,872	15,913	15,936	15,987	16,038	16,085	16,134	16,181	16,227	16,271
Howard	18,600	18,638	18,683	18,709	18,754	18,799	18,845	18,889	18,932	18,974	19,016
Montgomery	69,334	69,420	69,476	69,476	69,558	69,636	69,714	69,789	69,865	69,939	70,014
Prince George’s	82,190	82,316	82,405	82,405	82,538	82,670	82,798	82,924	83,047	83,167	83,287

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:											
	4/23	4/24	4/25	4/26	4/28			4/30			5/2					
Anne Arundel	41,852	42,014	42,103	42,150	42,370	(8,474)	[2,034]	{1,017}	42,584	(8,517)	[2,044]	{1,022}	42,799	(8,560)	[2,054]	{1,027}
Baltimore City	49,950	50,147	50,311	50,423	50,787	(10,157)	[2,438]	{1,219}	51,134	(10,227)	[2,454]	{1,227}	51,470	(10,294)	[2,471]	{1,235}
Baltimore County	62,136	62,391	62,566	62,652	63,118	(12,624)	[3,030]	{1,515}	63,560	(12,712)	[3,051]	{1,525}	63,998	(12,800)	[3,072]	{1,536}
Charles	10,407	10,423	10,435	10,435	10,477	(2,095)	[503]	{251}	10,519	(2,104)	[505]	{252}	10,559	(2,112)	[507]	{253}
Frederick	19,282	19,304	19,323	19,323	19,382	(3,876)	[930]	{465}	19,438	(3,888)	[933]	{467}	19,491	(3,898)	[936]	{468}
Harford	15,811	15,872	15,913	15,936	16,038	(3,208)	[770]	{385}	16,134	(3,227)	[774]	{387}	16,227	(3,245)	[779]	{389}
Howard	18,600	18,638	18,683	18,709	18,799	(3,760)	[902]	{451}	18,889	(3,778)	[907]	{453}	18,974	(3,795)	[911]	{455}
Montgomery	69,334	69,420	69,476	69,476	69,636	(13,927)	[3,343]	{1,671}	69,789	(13,958)	[3,350]	{1,675}	69,939	(13,988)	[3,357]	{1,679}
Prince George's	82,190	82,316	82,405	82,405	82,670	(16,534)	[3,968]	{1,984}	82,924	(16,585)	[3,980]	{1,990}	83,167	(16,633)	[3,992]	{1,996}

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.