

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

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 4/19/21 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.

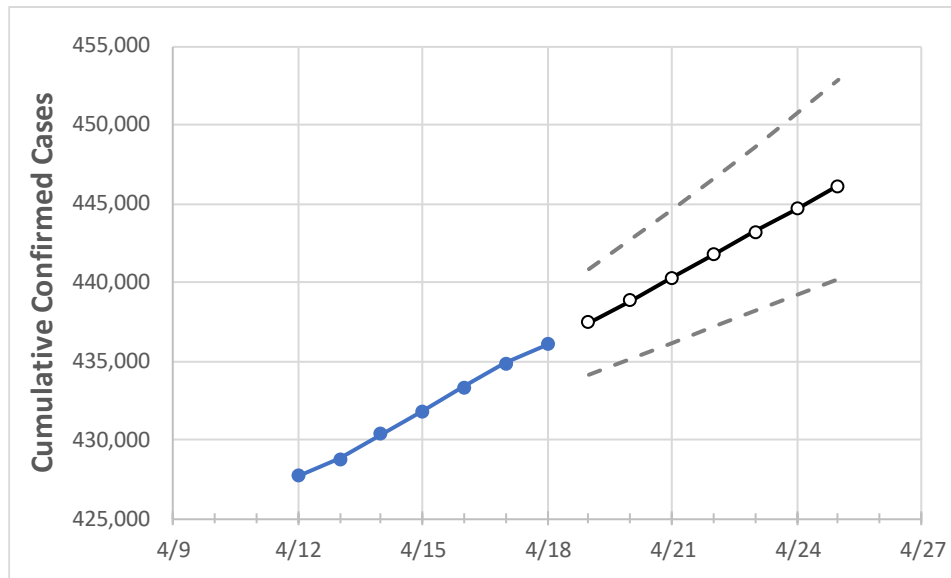
IEM's Modeling Lead

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:						
	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25
Maryland	431,795	433,359	434,859	436,028	437,425	438,857	440,281	441,737	443,206	444,650	446,116

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:						
	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25
Anne Arundel	40,905	41,045	41,221	41,312	41,447	41,582	41,721	41,860	42,000	42,138	42,280
Baltimore City	48,311	48,579	48,885	49,104	49,381	49,659	49,933	50,219	50,508	50,797	51,092
Baltimore County	60,053	60,389	60,716	60,935	61,238	61,553	61,875	62,198	62,519	62,855	63,189
Charles	10,214	10,241	10,269	10,284	10,311	10,336	10,361	10,387	10,413	10,439	10,464
Frederick	19,002	19,039	19,088	19,111	19,158	19,206	19,254	19,302	19,349	19,398	19,445
Harford	15,304	15,395	15,480	15,552	15,630	15,709	15,787	15,864	15,942	16,017	16,092
Howard	18,192	18,249	18,342	18,385	18,447	18,509	18,573	18,639	18,704	18,770	18,836
Montgomery	68,623	68,718	68,842	68,865	68,970	69,074	69,174	69,277	69,377	69,476	69,572
Prince George's	81,035	81,190	81,342	81,382	81,546	81,712	81,873	82,035	82,199	82,357	82,513

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:											
	4/15	4/16	4/17	4/18	4/20				4/22				4/24			
Anne Arundel	40,905	41,045	41,221	41,312	41,582	(8,316)	[1,996]	{998}	41,860	(8,372)	[2,009]	{1,005}	42,138	(8,428)	[2,023]	{1,011}
Baltimore City	48,311	48,579	48,885	49,104	49,659	(9,932)	[2,384]	{1,192}	50,219	(10,044)	[2,410]	{1,205}	50,797	(10,159)	[2,438]	{1,219}
Baltimore County	60,053	60,389	60,716	60,935	61,553	(12,311)	[2,955]	{1,477}	62,198	(12,440)	[2,986]	{1,493}	62,855	(12,571)	[3,017]	{1,509}
Charles	10,214	10,241	10,269	10,284	10,336	(2,067)	[496]	{248}	10,387	(2,077)	[499]	{249}	10,439	(2,088)	[501]	{251}
Frederick	19,002	19,039	19,088	19,111	19,206	(3,841)	[922]	{461}	19,302	(3,860)	[926]	{463}	19,398	(3,880)	[931]	{466}
Harford	15,304	15,395	15,480	15,552	15,709	(3,142)	[754]	{377}	15,864	(3,173)	[761]	{381}	16,017	(3,203)	[769]	{384}
Howard	18,192	18,249	18,342	18,385	18,509	(3,702)	[888]	{444}	18,639	(3,728)	[895]	{447}	18,770	(3,754)	[901]	{450}
Montgomery	68,623	68,718	68,842	68,865	69,074	(13,815)	[3,316]	{1,658}	69,277	(13,855)	[3,325]	{1,663}	69,476	(13,895)	[3,335]	{1,667}
Prince George's	81,035	81,190	81,342	81,382	81,712	(16,342)	[3,922]	{1,961}	82,035	(16,407)	[3,938]	{1,969}	82,357	(16,471)	[3,953]	{1,977}

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.