

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

Date: 3/30/21

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 3/30/21 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.

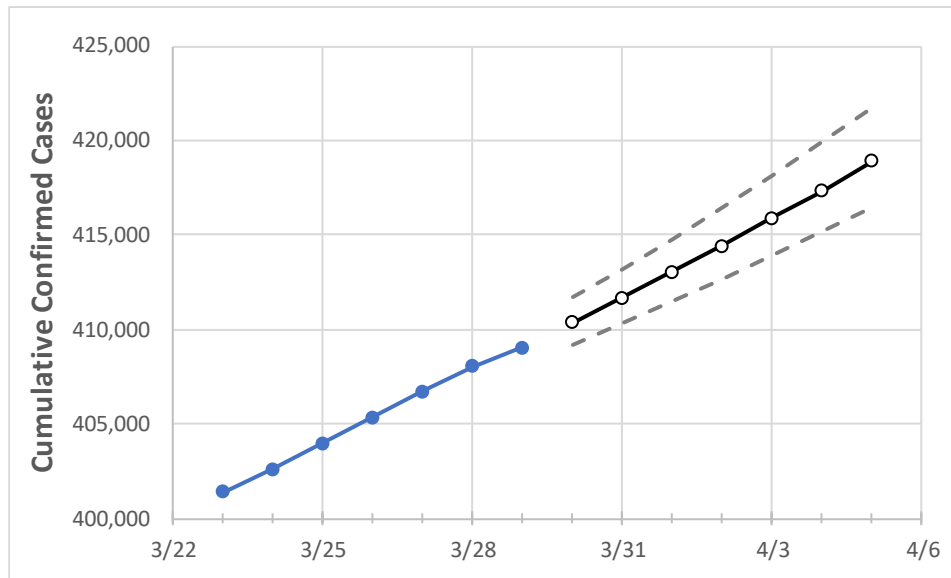
IEM's Modeling Lead

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Maryland	405,343	406,709	408,044	409,075	410,380	411,708	413,063	414,452	415,887	417,359	418,894

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Anne Arundel	38,308	38,446	38,572	38,671	38,808	38,948	39,094	39,241	39,394	39,553	39,713
Baltimore City	43,578	43,782	44,016	44,237	44,473	44,718	44,976	45,244	45,520	45,808	46,102
Baltimore County	54,740	55,000	55,245	55,451	55,685	55,935	56,196	56,454	56,723	56,998	57,286
Charles	9,620	9,648	9,676	9,695	9,724	9,752	9,781	9,809	9,839	9,868	9,898
Frederick	18,003	18,053	18,097	18,133	18,182	18,231	18,281	18,332	18,384	18,435	18,489
Harford	13,634	13,742	13,826	13,898	13,979	14,064	14,151	14,242	14,336	14,437	14,544
Howard	16,959	17,044	17,106	17,148	17,203	17,261	17,320	17,380	17,442	17,503	17,568
Montgomery	66,250	66,392	66,491	66,589	66,717	66,848	66,978	67,111	67,245	67,380	67,520
Prince George's	77,370	77,573	77,701	77,820	77,996	78,176	78,355	78,542	78,728	78,918	79,110

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:											
	3/26	3/27	3/28	3/29	3/31				4/2				4/4			
Anne Arundel	38,308	38,446	38,572	38,671	38,948	(7,790)	[1,870]	{935}	39,241	(7,848)	[1,884]	{942}	39,553	(7,911)	[1,899]	{949}
Baltimore City	43,578	43,782	44,016	44,237	44,718	(8,944)	[2,146]	{1,073}	45,244	(9,049)	[2,172]	{1,086}	45,808	(9,162)	[2,199]	{1,099}
Baltimore County	54,740	55,000	55,245	55,451	55,935	(11,187)	[2,685]	{1,342}	56,454	(11,291)	[2,710]	{1,355}	56,998	(11,400)	[2,736]	{1,368}
Charles	9,620	9,648	9,676	9,695	9,752	(1,950)	[468]	{234}	9,809	(1,962)	[471]	{235}	9,868	(1,974)	[474]	{237}
Frederick	18,003	18,053	18,097	18,133	18,231	(3,646)	[875]	{438}	18,332	(3,666)	[880]	{440}	18,435	(3,687)	[885]	{442}
Harford	13,634	13,742	13,826	13,898	14,064	(2,813)	[675]	{338}	14,242	(2,848)	[684]	{342}	14,437	(2,887)	[693]	{346}
Howard	16,959	17,044	17,106	17,148	17,261	(3,452)	[829]	{414}	17,380	(3,476)	[834]	{417}	17,503	(3,501)	[840]	{420}
Montgomery	66,250	66,392	66,491	66,589	66,848	(13,370)	[3,209]	{1,604}	67,111	(13,422)	[3,221]	{1,611}	67,380	(13,476)	[3,234]	{1,617}
Prince George's	77,370	77,573	77,701	77,820	78,176	(15,635)	[3,752]	{1,876}	78,542	(15,708)	[3,770]	{1,885}	78,918	(15,784)	[3,788]	{1,894}

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.