

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

Date: 1/26/21

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 1/26/21 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.

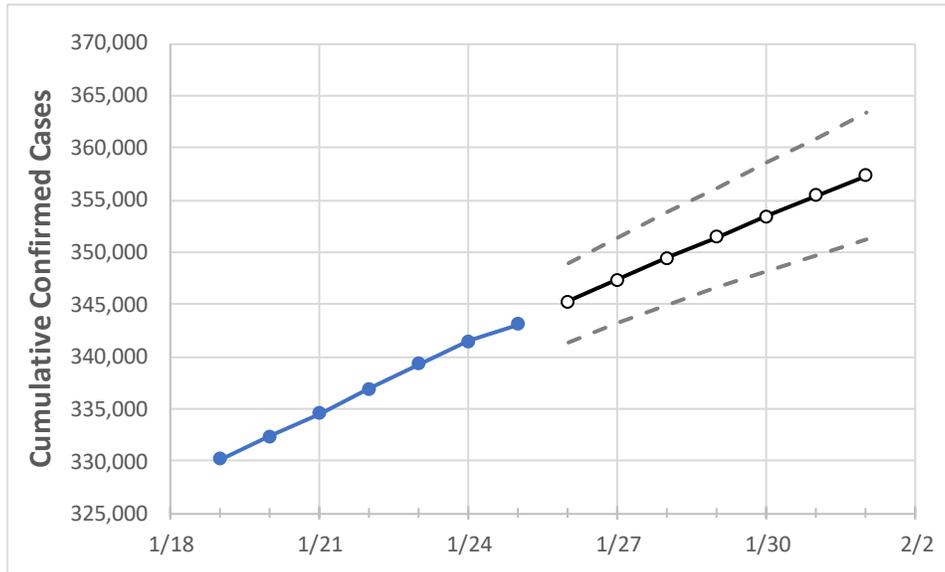
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Maryland	336,915	339,307	341,452	343,138	345,271	347,353	349,438	351,487	353,482	355,410	357,322

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Anne Arundel	31,125	31,396	31,599	31,764	31,998	32,227	32,453	32,673	32,888	33,097	33,307
Baltimore City	36,453	36,688	36,886	37,023	37,209	37,389	37,564	37,741	37,917	38,090	38,262
Baltimore County	45,197	45,459	45,671	45,847	46,083	46,309	46,536	46,759	46,983	47,196	47,417
Charles	7,470	7,551	7,667	7,719	7,787	7,853	7,919	7,988	8,057	8,123	8,191
Frederick	14,817	14,925	15,113	15,216	15,330	15,443	15,555	15,668	15,778	15,888	15,992
Harford	10,649	10,736	10,821	10,896	10,982	11,069	11,156	11,242	11,330	11,416	11,503
Howard	13,860	13,954	14,028	14,077	14,161	14,244	14,324	14,403	14,483	14,560	14,639
Montgomery	55,951	56,328	57,129	57,326	57,665	58,009	58,354	58,690	59,032	59,371	59,703
Prince George’s	64,830	65,151	65,865	66,159	66,568	66,970	67,375	67,784	68,188	68,580	68,967

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:											
	1/22	1/23	1/24	1/25	1/27			1/29			1/31					
Anne Arundel	31,125	31,396	31,599	31,764	32,227	(6,445)	[1,547]	{773}	32,673	(6,535)	[1,568]	{784}	33,097	(6,619)	[1,589]	{794}
Baltimore City	36,453	36,688	36,886	37,023	37,389	(7,478)	[1,795]	{897}	37,741	(7,548)	[1,812]	{906}	38,090	(7,618)	[1,828]	{914}
Baltimore County	45,197	45,459	45,671	45,847	46,309	(9,262)	[2,223]	{1,111}	46,759	(9,352)	[2,244]	{1,122}	47,196	(9,439)	[2,265]	{1,133}
Charles	7,470	7,551	7,667	7,719	7,853	(1,571)	[377]	{188}	7,988	(1,598)	[383]	{192}	8,123	(1,625)	[390]	{195}
Frederick	14,817	14,925	15,113	15,216	15,443	(3,089)	[741]	{371}	15,668	(3,134)	[752]	{376}	15,888	(3,178)	[763]	{381}
Harford	10,649	10,736	10,821	10,896	11,069	(2,214)	[531]	{266}	11,242	(2,248)	[540]	{270}	11,416	(2,283)	[548]	{274}
Howard	13,860	13,954	14,028	14,077	14,244	(2,849)	[684]	{342}	14,403	(2,881)	[691]	{346}	14,560	(2,912)	[699]	{349}
Montgomery	55,951	56,328	57,129	57,326	58,009	(11,602)	[2,784]	{1,392}	58,690	(11,738)	[2,817]	{1,409}	59,371	(11,874)	[2,850]	{1,425}
Prince George's	64,830	65,151	65,865	66,159	66,970	(13,394)	[3,215]	{1,607}	67,784	(13,557)	[3,254]	{1,627}	68,580	(13,716)	[3,292]	{1,646}

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.