

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/28/20**

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/28/20 11 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.

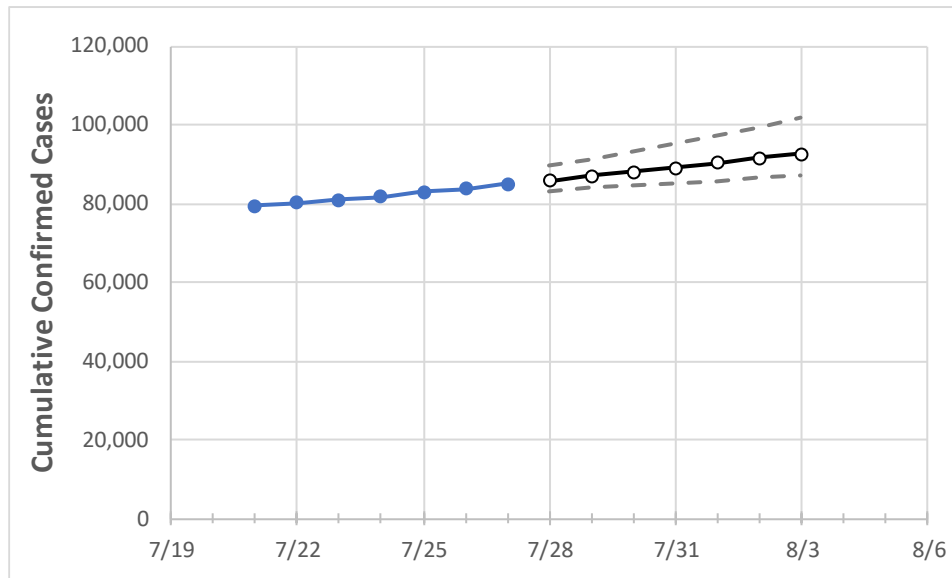
IEM's Modeling Lead

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Maryland	81,766	83,054	83,748	84,876	85,869	86,901	87,974	89,088	90,247	91,451	92,701

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 20%, and are often within 10%, of actual confirmed cases.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Anne Arundel	6,229	6,343	6,380	6,469	6,537	6,608	6,681	6,757	6,836	6,917	7,000
Baltimore City	10,001	10,210	10,353	10,579	10,757	10,944	11,140	11,345	11,560	11,785	12,020
Baltimore County	10,520	10,793	10,924	11,124	11,356	11,565	11,778	11,984	12,180	12,371	12,592
Charles	1,719	1,730	1,753	1,772	1,793	1,815	1,837	1,861	1,885	1,911	1,938
Frederick	2,870	2,879	2,909	2,931	2,954	2,978	3,004	3,030	3,057	3,086	3,116
Harford	1,540	1,579	1,597	1,631	1,664	1,698	1,735	1,774	1,816	1,860	1,907
Howard	3,271	3,313	3,327	3,373	3,406	3,440	3,475	3,510	3,547	3,584	3,622
Montgomery	16,922	17,020	17,164	17,230	17,333	17,439	17,546	17,656	17,768	17,882	17,998
Prince George's	21,665	21,890	22,011	22,224	22,388	22,557	22,733	22,915	23,104	23,299	23,501

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:											
	7/24	7/25	7/26	7/27	7/29				7/31				8/2			
Anne Arundel	6,229	6,343	6,380	6,469	6,608	(1,322)	[317]	{159}	6,757	(1,351)	[324]	{162}	6,917	(1,383)	[332]	{166}
Baltimore City	10,001	10,210	10,353	10,579	10,944	(2,189)	[525]	{263}	11,345	(2,269)	[545]	{272}	11,785	(2,357)	[566]	{283}
Baltimore County	10,520	10,793	10,924	11,124	11,565	(2,313)	[555]	{278}	11,984	(2,397)	[575]	{288}	12,371	(2,474)	[594]	{297}
Charles	1,719	1,730	1,753	1,772	1,815	(363)	[87]	{44}	1,861	(372)	[89]	{45}	1,911	(382)	[92]	{46}
Frederick	2,870	2,879	2,909	2,931	2,978	(596)	[143]	{71}	3,030	(606)	[145]	{73}	3,086	(617)	[148]	{74}
Harford	1,540	1,579	1,597	1,631	1,698	(340)	[82]	{41}	1,774	(355)	[85]	{43}	1,860	(372)	[89]	{45}
Howard	3,271	3,313	3,327	3,373	3,440	(688)	[165]	{83}	3,510	(702)	[168]	{84}	3,584	(717)	[172]	{86}
Montgomery	16,922	17,020	17,164	17,230	17,439	(3,488)	[837]	{419}	17,656	(3,531)	[847]	{424}	17,882	(3,576)	[858]	{429}
Prince George's	21,665	21,890	22,011	22,224	22,557	(4,511)	[1,083]	{541}	22,915	(4,583)	[1,100]	{550}	23,299	(4,660)	[1,118]	{559}

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.