

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

Date: 8/11/20

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 8/11/20 12 p.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.

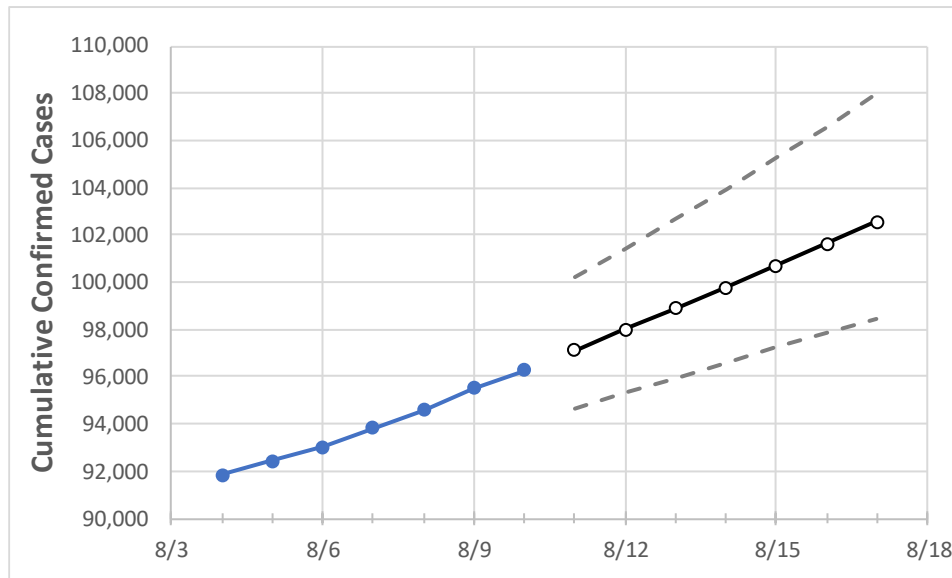
IEM's Modeling Lead

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:				
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Maryland	93,806	94,581	95,503	96,258	97,123	98,000	98,888	99,788	100,700	101,624	102,560

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:				
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Anne Arundel	7,243	7,295	7,361	7,416	7,482	7,548	7,616	7,685	7,754	7,825	7,896
Baltimore City	12,239	12,375	12,547	12,704	12,865	13,029	13,196	13,367	13,542	13,721	13,903
Baltimore County	12,915	13,060	13,257	13,400	13,565	13,732	13,902	14,075	14,250	14,428	14,608
Charles	2,000	2,024	2,040	2,067	2,090	2,114	2,138	2,164	2,189	2,216	2,243
Frederick	3,055	3,067	3,082	3,093	3,101	3,109	3,117	3,125	3,133	3,141	3,148
Harford	1,922	1,934	1,968	1,994	2,020	2,046	2,072	2,099	2,126	2,154	2,183
Howard	3,779	3,809	3,846	3,881	3,913	3,946	3,979	4,012	4,046	4,081	4,115
Montgomery	18,260	18,392	18,489	18,558	18,649	18,740	18,832	18,924	19,017	19,110	19,204
Prince George's	23,850	24,019	24,149	24,284	24,435	24,588	24,743	24,900	25,060	25,222	25,386

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:											
	8/7	8/8	8/9	8/10	8/12				8/14				8/16			
Anne Arundel	7,243	7,295	7,361	7,416	7,548	(1,510)	[362]	{181}	7,685	(1,537)	[369]	{184}	7,825	(1,565)	[376]	{188}
Baltimore City	12,239	12,375	12,547	12,704	13,029	(2,606)	[625]	{313}	13,367	(2,673)	[642]	{321}	13,721	(2,744)	[659]	{329}
Baltimore County	12,915	13,060	13,257	13,400	13,732	(2,746)	[659]	{330}	14,075	(2,815)	[676]	{338}	14,428	(2,886)	[693]	{346}
Charles	2,000	2,024	2,040	2,067	2,114	(423)	[101]	{51}	2,164	(433)	[104]	{52}	2,216	(443)	[106]	{53}
Frederick	3,055	3,067	3,082	3,093	3,109	(622)	[149]	{75}	3,125	(625)	[150]	{75}	3,141	(628)	[151]	{75}
Harford	1,922	1,934	1,968	1,994	2,046	(409)	[98]	{49}	2,099	(420)	[101]	{50}	2,154	(431)	[103]	{52}
Howard	3,779	3,809	3,846	3,881	3,946	(789)	[189]	{95}	4,012	(802)	[193]	{96}	4,081	(816)	[196]	{98}
Montgomery	18,260	18,392	18,489	18,558	18,740	(3,748)	[900]	{450}	18,924	(3,785)	[908]	{454}	19,110	(3,822)	[917]	{459}
Prince George's	23,850	24,019	24,149	24,284	24,588	(4,918)	[1,180]	{590}	24,900	(4,980)	[1,195]	{598}	25,222	(5,044)	[1,211]	{605}

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.