

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

Date: 2/1/21

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 2/1/21 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.

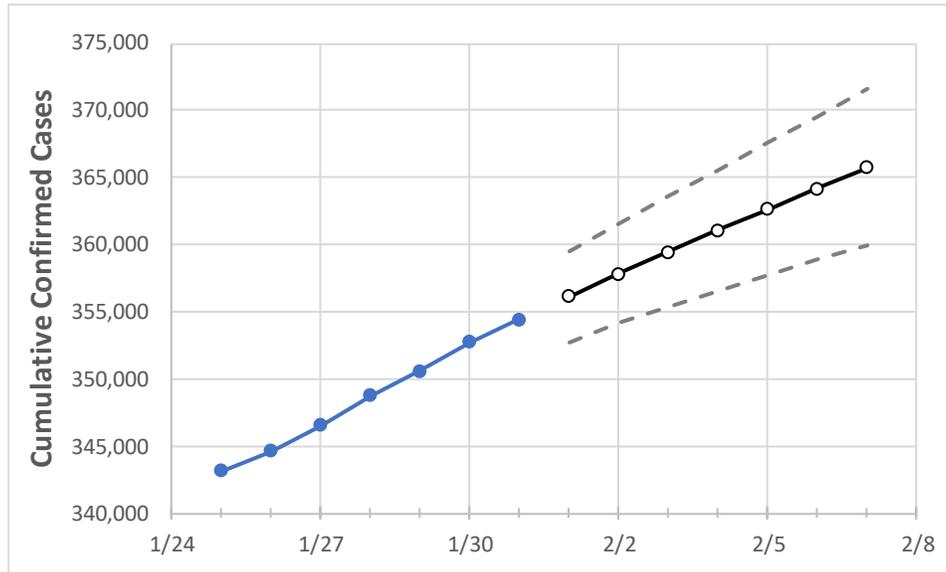
IEM's Modeling Lead

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:							
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	
Maryland	348,749	350,629	352,726	354,473	356,181	357,845	359,488	361,090	362,673	364,223	365,749	

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:							
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	
Anne Arundel	32,362	32,535	32,737	32,906	33,079	33,245	33,409	33,568	33,723	33,873	34,021	
Baltimore City	37,464	37,625	37,771	37,951	38,094	38,238	38,375	38,511	38,643	38,774	38,901	
Baltimore County	46,618	46,843	47,111	47,341	47,571	47,799	48,028	48,248	48,469	48,694	48,911	
Charles	7,909	7,965	8,022	8,022	8,085	8,149	8,214	8,278	8,344	8,410	8,474	
Frederick	15,447	15,531	15,615	15,615	15,698	15,779	15,854	15,930	16,005	16,076	16,146	
Harford	11,127	11,186	11,287	11,368	11,442	11,518	11,593	11,668	11,742	11,815	11,888	
Howard	14,330	14,408	14,496	14,572	14,638	14,704	14,768	14,831	14,892	14,953	15,010	
Montgomery	58,308	58,710	58,965	58,965	59,290	59,605	59,916	60,217	60,535	60,849	61,142	
Prince George's	67,262	67,583	67,883	67,883	68,213	68,541	68,859	69,173	69,488	69,793	70,106	

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:											
	1/28	1/29	1/30	1/31	2/2		2/4		2/6							
Anne Arundel	32,362	32,535	32,737	32,906	33,245	(6,649)	[1,596]	{798}	33,568	(6,714)	[1,611]	{806}	33,873	(6,775)	[1,626]	{813}
Baltimore City	37,464	37,625	37,771	37,951	38,238	(7,648)	[1,835]	{918}	38,511	(7,702)	[1,849]	{924}	38,774	(7,755)	[1,861]	{931}
Baltimore County	46,618	46,843	47,111	47,341	47,799	(9,560)	[2,294]	{1,147}	48,248	(9,650)	[2,316]	{1,158}	48,694	(9,739)	[2,337]	{1,169}
Charles	7,909	7,965	8,022	8,022	8,149	(1,630)	[391]	{196}	8,278	(1,656)	[397]	{199}	8,410	(1,682)	[404]	{202}
Frederick	15,447	15,531	15,615	15,615	15,779	(3,156)	[757]	{379}	15,930	(3,186)	[765]	{382}	16,076	(3,215)	[772]	{386}
Harford	11,127	11,186	11,287	11,368	11,518	(2,304)	[553]	{276}	11,668	(2,334)	[560]	{280}	11,815	(2,363)	[567]	{284}
Howard	14,330	14,408	14,496	14,572	14,704	(2,941)	[706]	{353}	14,831	(2,966)	[712]	{356}	14,953	(2,991)	[718]	{359}
Montgomery	58,308	58,710	58,965	58,965	59,605	(11,921)	[2,861]	{1,431}	60,217	(12,043)	[2,890]	{1,445}	60,849	(12,170)	[2,921]	{1,460}
Prince George's	67,262	67,583	67,883	67,883	68,541	(13,708)	[3,290]	{1,645}	69,173	(13,835)	[3,320]	{1,660}	69,793	(13,959)	[3,350]	{1,675}

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.