

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

Date: 1/6/21

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 1/6/21 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.

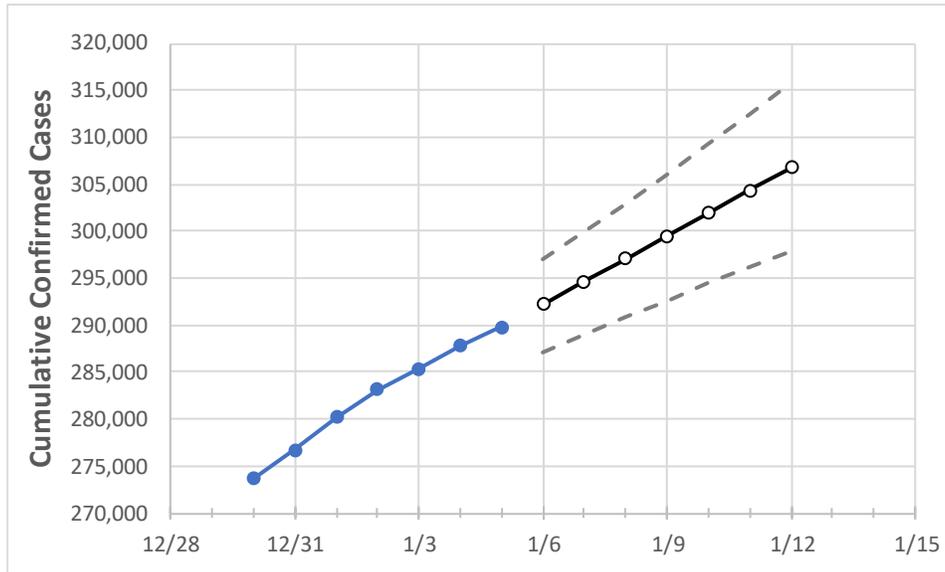
IEM's Modeling Lead

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Maryland	283,171	285,319	287,802	289,758	292,173	294,630	297,073	299,517	301,943	304,376	306,811

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Anne Arundel	25,143	25,365	25,629	25,781	26,036	26,288	26,548	26,802	27,056	27,309	27,560
Baltimore City	32,132	32,317	32,503	32,689	32,892	33,096	33,300	33,504	33,711	33,917	34,127
Baltimore County	39,351	39,608	39,851	40,026	40,272	40,515	40,757	40,995	41,231	41,462	41,697
Charles	6,229	6,288	6,328	6,396	6,450	6,504	6,558	6,613	6,667	6,722	6,776
Frederick	11,868	12,054	12,190	12,309	12,476	12,645	12,816	12,986	13,162	13,335	13,514
Harford	8,789	8,856	8,957	9,005	9,082	9,158	9,235	9,313	9,389	9,469	9,546
Howard	11,486	11,564	11,657	11,744	11,841	11,937	12,034	12,130	12,230	12,329	12,429
Montgomery	47,575	48,089	48,351	48,864	49,273	49,688	50,095	50,508	50,929	51,342	51,755
Prince George's	56,028	56,391	56,813	57,286	57,685	58,077	58,467	58,862	59,249	59,646	60,037

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:											
	1/2	1/3	1/4	1/5	1/7			1/9			1/11					
Anne Arundel	25,143	25,365	25,629	25,781	26,288	(5,258)	[1,262]	{631}	26,802	(5,360)	[1,286]	{643}	27,309	(5,462)	[1,311]	{655}
Baltimore City	32,132	32,317	32,503	32,689	33,096	(6,619)	[1,589]	{794}	33,504	(6,701)	[1,608]	{804}	33,917	(6,783)	[1,628]	{814}
Baltimore County	39,351	39,608	39,851	40,026	40,515	(8,103)	[1,945]	{972}	40,995	(8,199)	[1,968]	{984}	41,462	(8,292)	[1,990]	{995}
Charles	6,229	6,288	6,328	6,396	6,504	(1,301)	[312]	{156}	6,613	(1,323)	[317]	{159}	6,722	(1,344)	[323]	{161}
Frederick	11,868	12,054	12,190	12,309	12,645	(2,529)	[607]	{303}	12,986	(2,597)	[623]	{312}	13,335	(2,667)	[640]	{320}
Harford	8,789	8,856	8,957	9,005	9,158	(1,832)	[440]	{220}	9,313	(1,863)	[447]	{224}	9,469	(1,894)	[455]	{227}
Howard	11,486	11,564	11,657	11,744	11,937	(2,387)	[573]	{286}	12,130	(2,426)	[582]	{291}	12,329	(2,466)	[592]	{296}
Montgomery	47,575	48,089	48,351	48,864	49,688	(9,938)	[2,385]	{1,193}	50,508	(10,102)	[2,424]	{1,212}	51,342	(10,268)	[2,464]	{1,232}
Prince George's	56,028	56,391	56,813	57,286	58,077	(11,615)	[2,788]	{1,394}	58,862	(11,772)	[2,825]	{1,413}	59,646	(11,929)	[2,863]	{1,432}

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.