

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

Date: 1/5/21

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 1/5/21 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.**

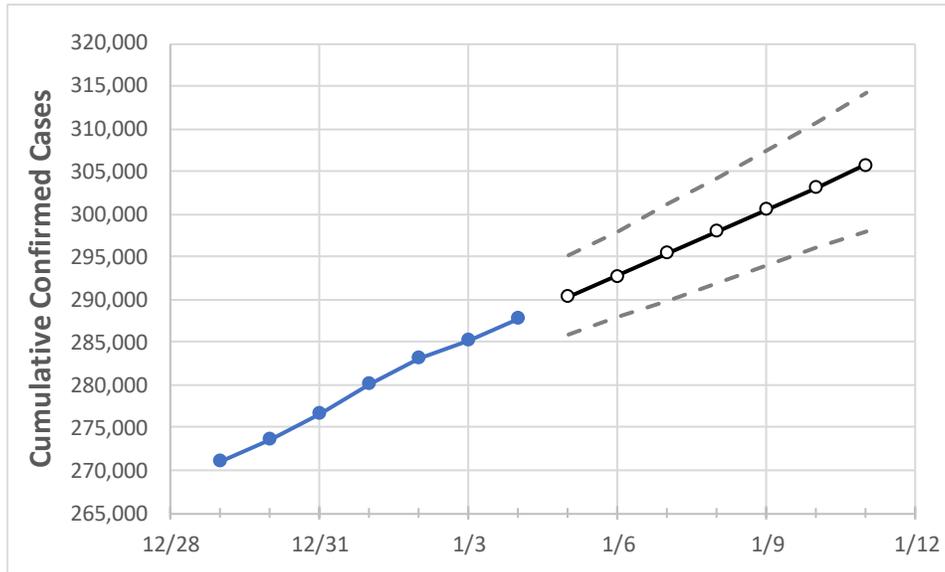
### IEM's Modeling Lead

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:				
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Maryland	280,219	283,171	285,319	287,802	290,329	292,870	295,447	298,031	300,559	303,140	305,755

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Anne Arundel	24,815	25,143	25,365	25,629	25,891	26,154	26,417	26,688	26,956	27,227	27,501
Baltimore City	31,911	32,132	32,317	32,503	32,709	32,915	33,124	33,331	33,538	33,745	33,952
Baltimore County	39,001	39,351	39,608	39,851	40,110	40,369	40,623	40,882	41,136	41,397	41,652
Charles	6,180	6,229	6,288	6,328	6,379	6,430	6,480	6,532	6,584	6,636	6,687
Frederick	11,652	11,868	12,054	12,190	12,368	12,546	12,728	12,913	13,097	13,283	13,468
Harford	8,660	8,789	8,856	8,957	9,039	9,123	9,205	9,290	9,373	9,457	9,539
Howard	11,363	11,486	11,564	11,657	11,758	11,857	11,958	12,058	12,157	12,258	12,356
Montgomery	47,147	47,575	48,089	48,351	48,751	49,155	49,569	49,972	50,376	50,776	51,188
Prince George’s	55,694	56,028	56,391	56,813	57,198	57,573	57,953	58,323	58,702	59,070	59,444

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:											
	1/1	1/2	1/3	1/4	1/6		1/8		1/10							
Anne Arundel	24,815	25,143	25,365	25,629	26,154	(5,231)	[1,255]	{628}	26,688	(5,338)	[1,281]	{641}	27,227	(5,445)	[1,307]	{653}
Baltimore City	31,911	32,132	32,317	32,503	32,915	(6,583)	[1,580]	{790}	33,331	(6,666)	[1,600]	{800}	33,745	(6,749)	[1,620]	{810}
Baltimore County	39,001	39,351	39,608	39,851	40,369	(8,074)	[1,938]	{969}	40,882	(8,176)	[1,962]	{981}	41,397	(8,279)	[1,987]	{994}
Charles	6,180	6,229	6,288	6,328	6,430	(1,286)	[309]	{154}	6,532	(1,306)	[314]	{157}	6,636	(1,327)	[319]	{159}
Frederick	11,652	11,868	12,054	12,190	12,546	(2,509)	[602]	{301}	12,913	(2,583)	[620]	{310}	13,283	(2,657)	[638]	{319}
Harford	8,660	8,789	8,856	8,957	9,123	(1,825)	[438]	{219}	9,290	(1,858)	[446]	{223}	9,457	(1,891)	[454]	{227}
Howard	11,363	11,486	11,564	11,657	11,857	(2,371)	[569]	{285}	12,058	(2,412)	[579]	{289}	12,258	(2,452)	[588]	{294}
Montgomery	47,147	47,575	48,089	48,351	49,155	(9,831)	[2,359]	{1,180}	49,972	(9,994)	[2,399]	{1,199}	50,776	(10,155)	[2,437]	{1,219}
Prince George's	55,694	56,028	56,391	56,813	57,573	(11,515)	[2,763]	{1,382}	58,323	(11,665)	[2,800]	{1,400}	59,070	(11,814)	[2,835]	{1,418}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.