

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/10/22**

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 1/10/22 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.

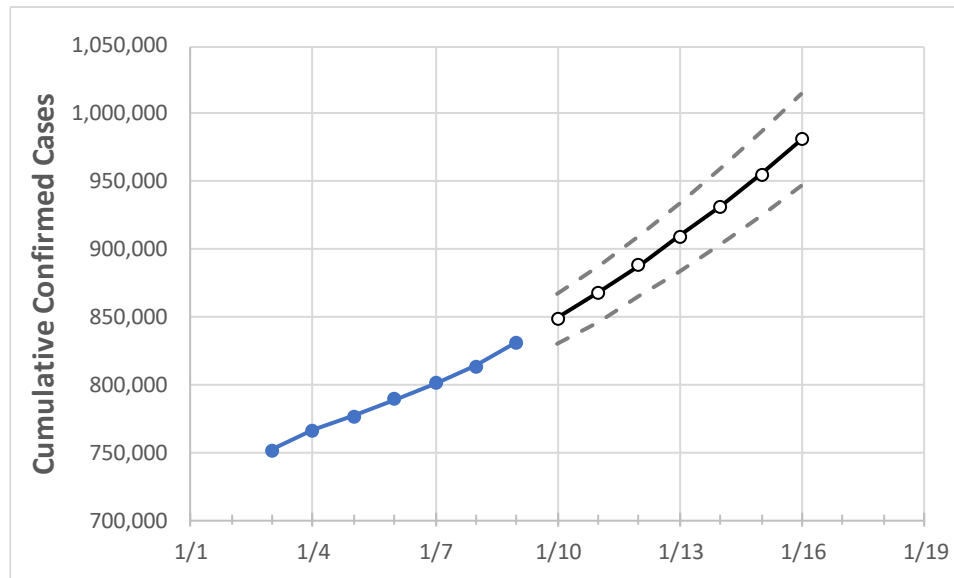
IEM's Modeling Lead

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:							
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	
Maryland	788,965	800,743	813,688	830,940	849,013	868,022	888,056	909,221	931,873	955,572	980,822	

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:							
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	
Anne Arundel	71,497	72,554	73,331	74,629	75,850	77,113	78,396	79,756	81,157	82,598	84,114	
Baltimore City	89,483	90,715	91,809	93,675	95,466	97,271	99,120	101,072	103,128	105,187	107,361	
Baltimore County	106,847	108,584	110,147	112,020	114,239	116,525	118,855	121,405	123,984	126,751	129,598	
Charles	21,505	21,967	22,296	22,625	23,153	23,686	24,246	24,820	25,431	26,064	26,727	
Frederick	35,326	35,948	36,465	36,982	37,739	38,520	39,334	40,179	41,070	41,984	42,965	
Harford	29,674	30,221	30,942	31,428	32,058	32,724	33,419	34,150	34,911	35,733	36,587	
Howard	32,956	33,440	33,919	34,886	35,722	36,614	37,539	38,510	39,552	40,641	41,773	
Montgomery	123,550	126,510	130,087	133,664	137,820	142,177	146,809	151,636	156,812	162,351	168,178	
Prince George's	140,746	142,932	144,898	146,864	149,798	152,881	156,026	159,405	162,817	166,418	170,199	

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:											
	1/6	1/7	1/8	1/9	1/11				1/13				1/15			
Anne Arundel	71,497	72,554	73,331	74,629	77,113	(15,423)	[3,701]	{1,851}	79,756	(15,951)	[3,828]	{1,914}	82,598	(16,520)	[3,965]	{1,982}
Baltimore City	89,483	90,715	91,809	93,675	97,271	(19,454)	[4,669]	{2,335}	101,072	(20,214)	[4,851]	{2,426}	105,187	(21,037)	[5,049]	{2,524}
Baltimore County	106,847	108,584	110,147	112,020	116,525	(23,305)	[5,593]	{2,797}	121,405	(24,281)	[5,827]	{2,914}	126,751	(25,350)	[6,084]	{3,042}
Charles	21,505	21,967	22,296	22,625	23,686	(4,737)	[1,137]	{568}	24,820	(4,964)	[1,191]	{596}	26,064	(5,213)	[1,251]	{626}
Frederick	35,326	35,948	36,465	36,982	38,520	(7,704)	[1,849]	{924}	40,179	(8,036)	[1,929]	{964}	41,984	(8,397)	[2,015]	{1,008}
Harford	29,674	30,221	30,942	31,428	32,724	(6,545)	[1,571]	{785}	34,150	(6,830)	[1,639]	{820}	35,733	(7,147)	[1,715]	{858}
Howard	32,956	33,440	33,919	34,886	36,614	(7,323)	[1,757]	{879}	38,510	(7,702)	[1,848]	{924}	40,641	(8,128)	[1,951]	{975}
Montgomery	123,550	126,510	130,087	133,664	142,177	(28,435)	[6,824]	{3,412}	151,636	(30,327)	[7,279]	{3,639}	162,351	(32,470)	[7,793]	{3,896}
Prince George's	140,746	142,932	144,898	146,864	152,881	(30,576)	[7,338]	{3,669}	159,405	(31,881)	[7,651]	{3,826}	166,418	(33,284)	[7,988]	{3,994}

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.