

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

Date: 4/9/21

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 4/9/21 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.

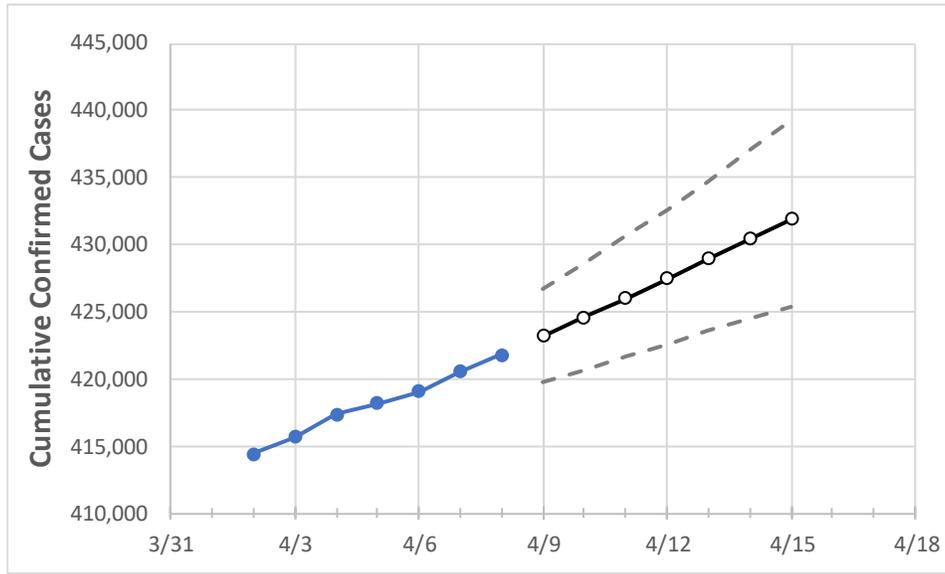
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Maryland	418,188	419,055	420,526	421,823	423,208	424,613	426,032	427,483	428,955	430,441	431,925

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Anne Arundel	39,578	39,658	39,773	39,902	40,022	40,144	40,265	40,387	40,509	40,629	40,755
Baltimore City	45,825	45,967	46,254	46,503	46,766	47,037	47,323	47,607	47,891	48,187	48,496
Baltimore County	57,222	57,383	57,709	57,972	58,272	58,581	58,900	59,229	59,568	59,924	60,278
Charles	9,906	9,937	9,965	9,965	9,994	10,023	10,052	10,081	10,111	10,140	10,170
Frederick	18,479	18,507	18,575	18,575	18,625	18,674	18,724	18,774	18,826	18,879	18,931
Harford	14,490	14,553	14,652	14,738	14,836	14,939	15,043	15,149	15,254	15,368	15,480
Howard	17,605	17,641	17,718	17,749	17,814	17,881	17,948	18,017	18,091	18,164	18,236
Montgomery	67,375	67,505	67,613	67,613	67,721	67,827	67,934	68,042	68,150	68,257	68,363
Prince George’s	79,087	79,286	79,453	79,453	79,631	79,810	79,987	80,168	80,347	80,529	80,714

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:											
	4/5	4/6	4/7	4/8	4/10			4/12			4/14					
Anne Arundel	39,578	39,658	39,773	39,902	40,144	(8,029)	[1,927]	{963}	40,387	(8,077)	[1,939]	{969}	40,629	(8,126)	[1,950]	{975}
Baltimore City	45,825	45,967	46,254	46,503	47,037	(9,407)	[2,258]	{1,129}	47,607	(9,521)	[2,285]	{1,143}	48,187	(9,637)	[2,313]	{1,156}
Baltimore County	57,222	57,383	57,709	57,972	58,581	(11,716)	[2,812]	{1,406}	59,229	(11,846)	[2,843]	{1,422}	59,924	(11,985)	[2,876]	{1,438}
Charles	9,906	9,937	9,965	9,965	10,023	(2,005)	[481]	{241}	10,081	(2,016)	[484]	{242}	10,140	(2,028)	[487]	{243}
Frederick	18,479	18,507	18,575	18,575	18,674	(3,735)	[896]	{448}	18,774	(3,755)	[901]	{451}	18,879	(3,776)	[906]	{453}
Harford	14,490	14,553	14,652	14,738	14,939	(2,988)	[717]	{359}	15,149	(3,030)	[727]	{364}	15,368	(3,074)	[738]	{369}
Howard	17,605	17,641	17,718	17,749	17,881	(3,576)	[858]	{429}	18,017	(3,603)	[865]	{432}	18,164	(3,633)	[872]	{436}
Montgomery	67,375	67,505	67,613	67,613	67,827	(13,565)	[3,256]	{1,628}	68,042	(13,608)	[3,266]	{1,633}	68,257	(13,651)	[3,276]	{1,638}
Prince George's	79,087	79,286	79,453	79,453	79,810	(15,962)	[3,831]	{1,915}	80,168	(16,034)	[3,848]	{1,924}	80,529	(16,106)	[3,865]	{1,933}

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.