

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

Date: 4/5/21

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 4/5/21 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.

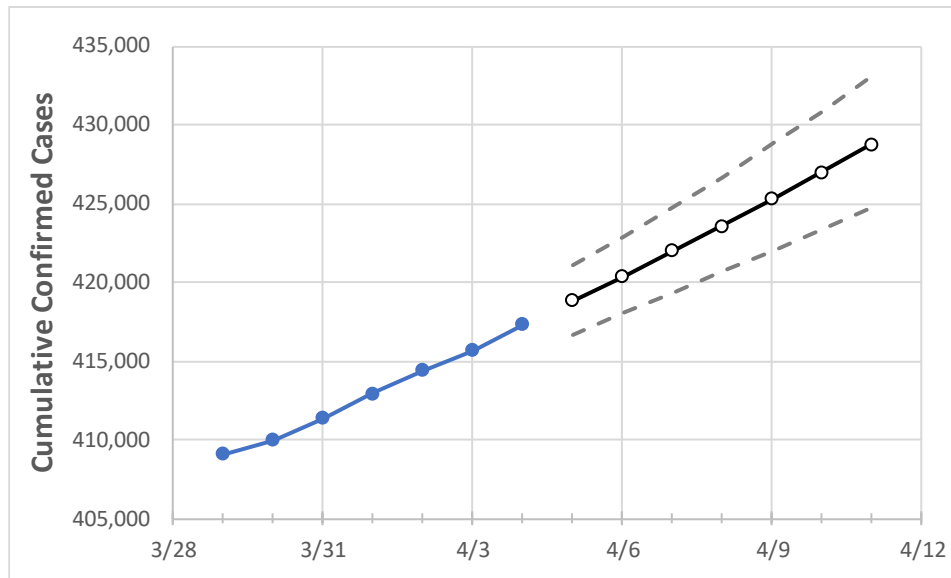
IEM's Modeling Lead

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:					
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Maryland	412,928	414,385	415,660	417,329	418,821	420,386	421,975	423,599	425,275	427,033	428,799

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Anne Arundel	39,062	39,217	39,345	39,483	39,630	39,782	39,937	40,096	40,253	40,417	40,581
Baltimore City	44,869	45,097	45,318	45,660	45,939	46,219	46,520	46,830	47,156	47,495	47,849
Baltimore County	56,179	56,503	56,735	57,083	57,390	57,711	58,044	58,391	58,751	59,128	59,516
Charles	9,803	9,826	9,872	9,895	9,929	9,962	9,996	10,031	10,064	10,099	10,135
Frederick	18,286	18,347	18,384	18,425	18,476	18,528	18,580	18,634	18,687	18,741	18,796
Harford	14,145	14,259	14,330	14,437	14,541	14,651	14,764	14,883	15,004	15,128	15,260
Howard	17,342	17,405	17,470	17,567	17,640	17,715	17,792	17,871	17,953	18,036	18,121
Montgomery	66,951	67,061	67,212	67,303	67,429	67,556	67,685	67,813	67,940	68,067	68,197
Prince George's	78,442	78,633	78,840	78,948	79,134	79,322	79,513	79,704	79,896	80,091	80,293

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:											
	4/1	4/2	4/3	4/4	4/6				4/8				4/10			
Anne Arundel	39,062	39,217	39,345	39,483	39,782	(7,956)	[1,910]	{955}	40,096	(8,019)	[1,925]	{962}	40,417	(8,083)	[1,940]	{970}
Baltimore City	44,869	45,097	45,318	45,660	46,219	(9,244)	[2,219]	{1,109}	46,830	(9,366)	[2,248]	{1,124}	47,495	(9,499)	[2,280]	{1,140}
Baltimore County	56,179	56,503	56,735	57,083	57,711	(11,542)	[2,770]	{1,385}	58,391	(11,678)	[2,803]	{1,401}	59,128	(11,826)	[2,838]	{1,419}
Charles	9,803	9,826	9,872	9,895	9,962	(1,992)	[478]	{239}	10,031	(2,006)	[481]	{241}	10,099	(2,020)	[485]	{242}
Frederick	18,286	18,347	18,384	18,425	18,528	(3,706)	[889]	{445}	18,634	(3,727)	[894]	{447}	18,741	(3,748)	[900]	{450}
Harford	14,145	14,259	14,330	14,437	14,651	(2,930)	[703]	{352}	14,883	(2,977)	[714]	{357}	15,128	(3,026)	[726]	{363}
Howard	17,342	17,405	17,470	17,567	17,715	(3,543)	[850]	{425}	17,871	(3,574)	[858]	{429}	18,036	(3,607)	[866]	{433}
Montgomery	66,951	67,061	67,212	67,303	67,556	(13,511)	[3,243]	{1,621}	67,813	(13,563)	[3,255]	{1,628}	68,067	(13,613)	[3,267]	{1,634}
Prince George's	78,442	78,633	78,840	78,948	79,322	(15,864)	[3,807]	{1,904}	79,704	(15,941)	[3,826]	{1,913}	80,091	(16,018)	[3,844]	{1,922}

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.