

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

Date: 1/15/21

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 1/15/21 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.

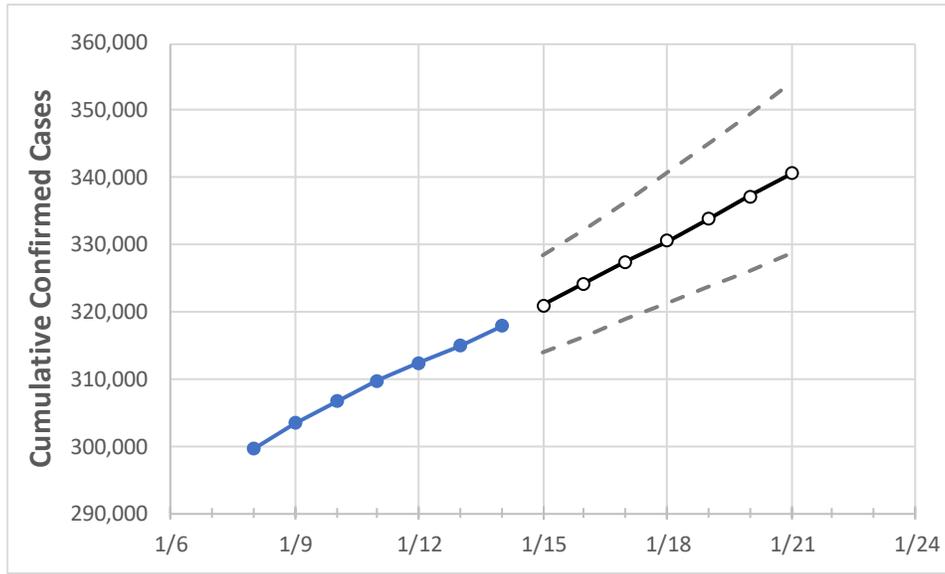
IEM's Modeling Lead

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Maryland	309,686	312,351	314,867	317,815	321,010	324,224	327,407	330,624	333,888	337,235	340,619

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Anne Arundel	28,202	28,416	28,675	29,016	29,385	29,758	30,144	30,534	30,935	31,337	31,741
Baltimore City	34,400	34,443	34,678	34,907	35,160	35,413	35,665	35,919	36,179	36,434	36,697
Baltimore County	42,307	42,505	42,810	43,103	43,435	43,777	44,120	44,465	44,820	45,178	45,538
Charles	6,818	6,890	6,957	7,022	7,093	7,165	7,237	7,311	7,387	7,461	7,538
Frederick	13,501	13,676	13,836	13,970	14,174	14,375	14,586	14,798	15,014	15,231	15,454
Harford	9,682	9,739	9,848	9,926	10,033	10,142	10,253	10,366	10,480	10,594	10,709
Howard	12,734	12,863	12,954	13,070	13,220	13,373	13,528	13,690	13,851	14,013	14,179
Montgomery	52,015	52,368	52,842	53,283	53,791	54,308	54,828	55,343	55,871	56,427	56,965
Prince George’s	60,505	60,972	61,516	61,946	62,473	63,012	63,553	64,095	64,650	65,218	65,782

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:											
	1/11	1/12	1/13	1/14	1/16			1/18			1/20					
Anne Arundel	28,202	28,416	28,675	29,016	29,758	(5,952)	[1,428]	{714}	30,534	(6,107)	[1,466]	{733}	31,337	(6,267)	[1,504]	{752}
Baltimore City	34,400	34,443	34,678	34,907	35,413	(7,083)	[1,700]	{850}	35,919	(7,184)	[1,724]	{862}	36,434	(7,287)	[1,749]	{874}
Baltimore County	42,307	42,505	42,810	43,103	43,777	(8,755)	[2,101]	{1,051}	44,465	(8,893)	[2,134]	{1,067}	45,178	(9,036)	[2,169]	{1,084}
Charles	6,818	6,890	6,957	7,022	7,165	(1,433)	[344]	{172}	7,311	(1,462)	[351]	{175}	7,461	(1,492)	[358]	{179}
Frederick	13,501	13,676	13,836	13,970	14,375	(2,875)	[690]	{345}	14,798	(2,960)	[710]	{355}	15,231	(3,046)	[731]	{366}
Harford	9,682	9,739	9,848	9,926	10,142	(2,028)	[487]	{243}	10,366	(2,073)	[498]	{249}	10,594	(2,119)	[509]	{254}
Howard	12,734	12,863	12,954	13,070	13,373	(2,675)	[642]	{321}	13,690	(2,738)	[657]	{329}	14,013	(2,803)	[673]	{336}
Montgomery	52,015	52,368	52,842	53,283	54,308	(10,862)	[2,607]	{1,303}	55,343	(11,069)	[2,656]	{1,328}	56,427	(11,285)	[2,708]	{1,354}
Prince George's	60,505	60,972	61,516	61,946	63,012	(12,602)	[3,025]	{1,512}	64,095	(12,819)	[3,077]	{1,538}	65,218	(13,044)	[3,130]	{1,565}

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.