

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

Date: 2/2/21

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 2/2/21 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.

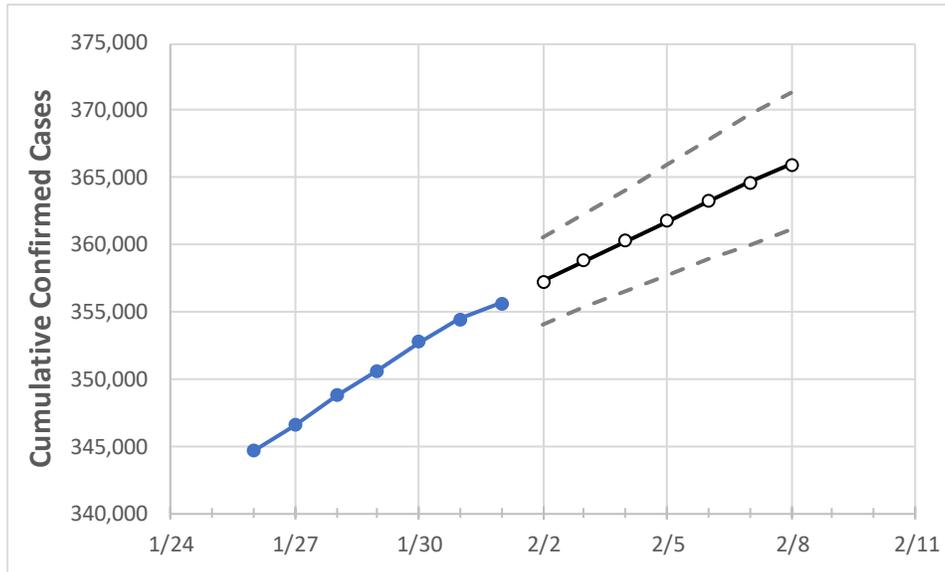
IEM's Modeling Lead

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Maryland	350,629	352,726	354,473	355,636	357,225	358,790	360,286	361,764	363,209	364,612	365,995	

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Anne Arundel	32,535	32,737	32,906	33,044	33,208	33,368	33,519	33,668	33,812	33,959	34,098	
Baltimore City	37,625	37,771	37,951	38,024	38,154	38,285	38,413	38,534	38,657	38,770	38,886	
Baltimore County	46,843	47,111	47,341	47,502	47,721	47,937	48,148	48,356	48,564	48,768	48,973	
Charles	7,965	8,022	8,060	8,087	8,142	8,195	8,249	8,303	8,355	8,407	8,458	
Frederick	15,531	15,615	15,646	15,722	15,794	15,862	15,931	15,997	16,058	16,118	16,178	
Harford	11,186	11,287	11,368	11,411	11,481	11,552	11,621	11,689	11,757	11,824	11,889	
Howard	14,408	14,496	14,572	14,631	14,697	14,760	14,821	14,881	14,940	14,998	15,055	
Montgomery	58,710	58,965	59,155	59,292	59,576	59,861	60,131	60,402	60,667	60,918	61,169	
Prince George’s	67,583	67,883	68,102	68,295	68,584	68,866	69,141	69,409	69,669	69,919	70,164	

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:											
	1/29	1/30	1/31	2/1	2/3		2/5		2/7							
Anne Arundel	32,535	32,737	32,906	33,044	33,368	(6,674)	[1,602]	{801}	33,668	(6,734)	[1,616]	{808}	33,959	(6,792)	[1,630]	{815}
Baltimore City	37,625	37,771	37,951	38,024	38,285	(7,657)	[1,838]	{919}	38,534	(7,707)	[1,850]	{925}	38,770	(7,754)	[1,861]	{930}
Baltimore County	46,843	47,111	47,341	47,502	47,937	(9,587)	[2,301]	{1,150}	48,356	(9,671)	[2,321]	{1,161}	48,768	(9,754)	[2,341]	{1,170}
Charles	7,965	8,022	8,060	8,087	8,195	(1,639)	[393]	{197}	8,303	(1,661)	[399]	{199}	8,407	(1,681)	[404]	{202}
Frederick	15,531	15,615	15,646	15,722	15,862	(3,172)	[761]	{381}	15,997	(3,199)	[768]	{384}	16,118	(3,224)	[774]	{387}
Harford	11,186	11,287	11,368	11,411	11,552	(2,310)	[554]	{277}	11,689	(2,338)	[561]	{281}	11,824	(2,365)	[568]	{284}
Howard	14,408	14,496	14,572	14,631	14,760	(2,952)	[708]	{354}	14,881	(2,976)	[714]	{357}	14,998	(3,000)	[720]	{360}
Montgomery	58,710	58,965	59,155	59,292	59,861	(11,972)	[2,873]	{1,437}	60,402	(12,080)	[2,899]	{1,450}	60,918	(12,184)	[2,924]	{1,462}
Prince George's	67,583	67,883	68,102	68,295	68,866	(13,773)	[3,306]	{1,653}	69,409	(13,882)	[3,332]	{1,666}	69,919	(13,984)	[3,356]	{1,678}

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.