

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

Date: 4/13/21

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 4/13/21 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.

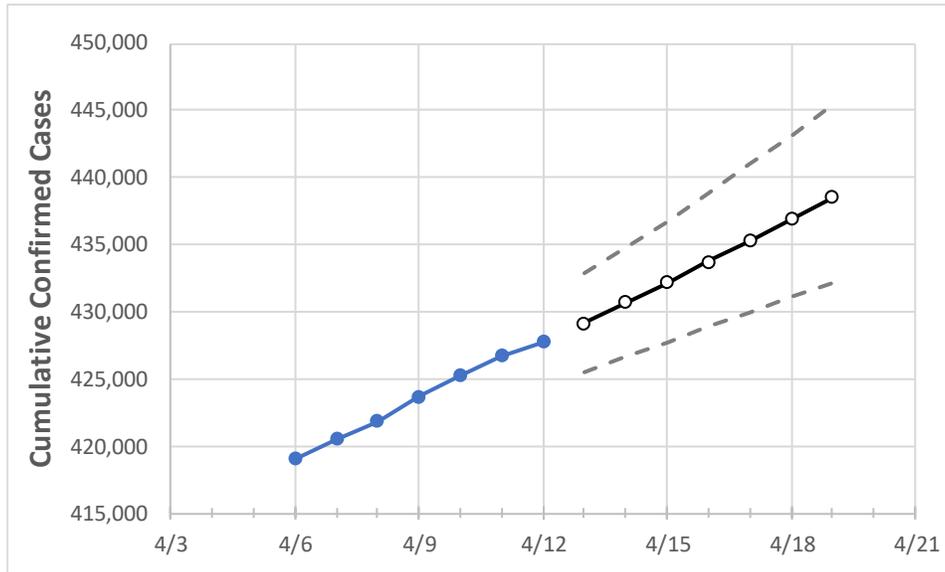
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Maryland	423,663	425,247	426,730	427,715	429,173	430,671	432,170	433,707	435,283	436,872	438,505

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Anne Arundel	40,112	40,271	40,427	40,489	40,626	40,759	40,893	41,031	41,166	41,306	41,445
Baltimore City	46,778	47,071	47,368	47,579	47,857	48,143	48,437	48,740	49,047	49,358	49,682
Baltimore County	58,366	58,697	58,992	59,201	59,518	59,844	60,186	60,533	60,889	61,252	61,622
Charles	10,042	10,079	10,094	10,125	10,156	10,187	10,217	10,249	10,280	10,310	10,342
Frederick	18,680	18,742	18,791	18,847	18,900	18,952	19,006	19,060	19,116	19,170	19,226
Harford	14,849	14,950	15,044	15,107	15,210	15,315	15,421	15,531	15,640	15,751	15,866
Howard	17,834	17,891	17,933	17,967	18,027	18,089	18,151	18,214	18,278	18,343	18,410
Montgomery	67,911	68,042	68,144	68,260	68,378	68,496	68,617	68,737	68,855	68,975	69,093
Prince George’s	79,901	80,109	80,228	80,370	80,553	80,736	80,920	81,107	81,294	81,485	81,673

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:											
	4/9	4/10	4/11	4/12	4/14			4/16			4/18					
Anne Arundel	40,112	40,271	40,427	40,489	40,759	(8,152)	[1,956]	{978}	41,031	(8,206)	[1,969]	{985}	41,306	(8,261)	[1,983]	{991}
Baltimore City	46,778	47,071	47,368	47,579	48,143	(9,629)	[2,311]	{1,155}	48,740	(9,748)	[2,340]	{1,170}	49,358	(9,872)	[2,369]	{1,185}
Baltimore County	58,366	58,697	58,992	59,201	59,844	(11,969)	[2,873]	{1,436}	60,533	(12,107)	[2,906]	{1,453}	61,252	(12,250)	[2,940]	{1,470}
Charles	10,042	10,079	10,094	10,125	10,187	(2,037)	[489]	{244}	10,249	(2,050)	[492]	{246}	10,310	(2,062)	[495]	{247}
Frederick	18,680	18,742	18,791	18,847	18,952	(3,790)	[910]	{455}	19,060	(3,812)	[915]	{457}	19,170	(3,834)	[920]	{460}
Harford	14,849	14,950	15,044	15,107	15,315	(3,063)	[735]	{368}	15,531	(3,106)	[745]	{373}	15,751	(3,150)	[756]	{378}
Howard	17,834	17,891	17,933	17,967	18,089	(3,618)	[868]	{434}	18,214	(3,643)	[874]	{437}	18,343	(3,669)	[880]	{440}
Montgomery	67,911	68,042	68,144	68,260	68,496	(13,699)	[3,288]	{1,644}	68,737	(13,747)	[3,299]	{1,650}	68,975	(13,795)	[3,311]	{1,655}
Prince George's	79,901	80,109	80,228	80,370	80,736	(16,147)	[3,875]	{1,938}	81,107	(16,221)	[3,893]	{1,947}	81,485	(16,297)	[3,911]	{1,956}

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.