

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/17/20**

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 12/17/20 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.

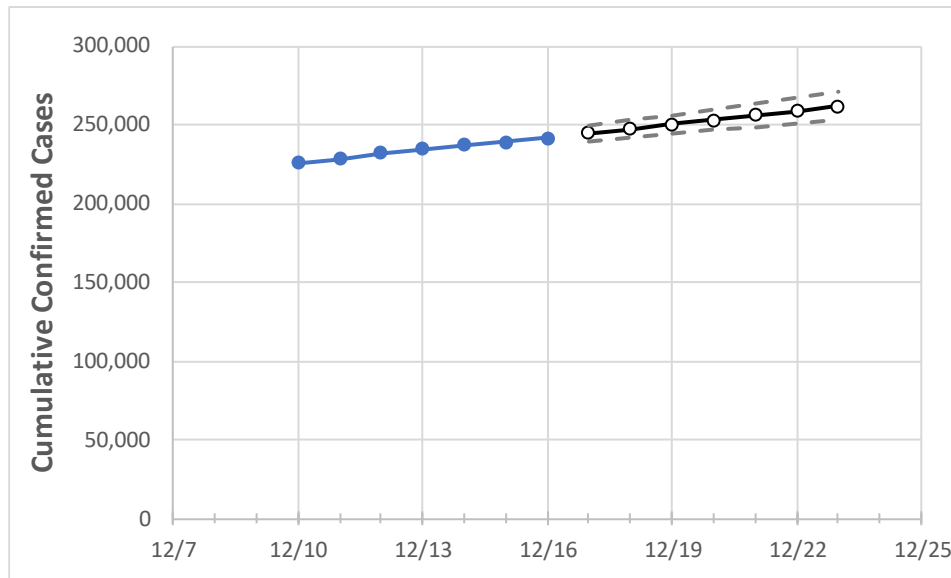
IEM's Modeling Lead

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Maryland	234,647	236,961	239,362	241,767	244,589	247,425	250,278	253,147	256,031	258,932	261,849

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 20%, and are often within 10%, of actual confirmed cases.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Anne Arundel	20,171	20,389	20,548	20,730	21,002	21,277	21,555	21,836	22,121	22,409	22,701
Baltimore City	28,046	28,270	28,407	28,586	28,830	29,073	29,315	29,557	29,798	30,038	30,278
Baltimore County	33,850	34,109	34,407	34,702	35,036	35,370	35,703	36,036	36,368	36,700	37,031
Charles	5,183	5,234	5,289	5,322	5,380	5,439	5,498	5,558	5,618	5,678	5,739
Frederick	8,820	8,966	9,081	9,241	9,404	9,570	9,740	9,913	10,089	10,269	10,452
Harford	7,192	7,256	7,357	7,442	7,524	7,605	7,687	7,769	7,851	7,932	8,014
Howard	9,633	9,711	9,783	9,855	9,964	10,074	10,184	10,294	10,405	10,516	10,628
Montgomery	39,721	40,062	40,500	40,747	41,217	41,690	42,167	42,647	43,131	43,618	44,109
Prince George's	47,682	48,232	48,718	49,068	49,548	50,031	50,517	51,005	51,495	51,988	52,484

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:											
	12/13	12/14	12/15	12/16	12/18				12/20				12/22			
Anne Arundel	20,171	20,389	20,548	20,730	21,277	(4,255)	[1,021]	{511}	21,836	(4,367)	[1,048]	{524}	22,409	(4,482)	[1,076]	{538}
Baltimore City	28,046	28,270	28,407	28,586	29,073	(5,815)	[1,395]	{698}	29,557	(5,911)	[1,419]	{709}	30,038	(6,008)	[1,442]	{721}
Baltimore County	33,850	34,109	34,407	34,702	35,370	(7,074)	[1,698]	{849}	36,036	(7,207)	[1,730]	{865}	36,700	(7,340)	[1,762]	{881}
Charles	5,183	5,234	5,289	5,322	5,439	(1,088)	[261]	{131}	5,558	(1,112)	[267]	{133}	5,678	(1,136)	[273]	{136}
Frederick	8,820	8,966	9,081	9,241	9,570	(1,914)	[459]	{230}	9,913	(1,983)	[476]	{238}	10,269	(2,054)	[493]	{246}
Harford	7,192	7,256	7,357	7,442	7,605	(1,521)	[365]	{183}	7,769	(1,554)	[373]	{186}	7,932	(1,586)	[381]	{190}
Howard	9,633	9,711	9,783	9,855	10,074	(2,015)	[484]	{242}	10,294	(2,059)	[494]	{247}	10,516	(2,103)	[505]	{252}
Montgomery	39,721	40,062	40,500	40,747	41,690	(8,338)	[2,001]	{1,001}	42,647	(8,529)	[2,047]	{1,024}	43,618	(8,724)	[2,094]	{1,047}
Prince George's	47,682	48,232	48,718	49,068	50,031	(10,006)	[2,402]	{1,201}	51,005	(10,201)	[2,448]	{1,224}	51,988	(10,398)	[2,495]	{1,248}

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.