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

Date: 2/16/22

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 2/16/22 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.

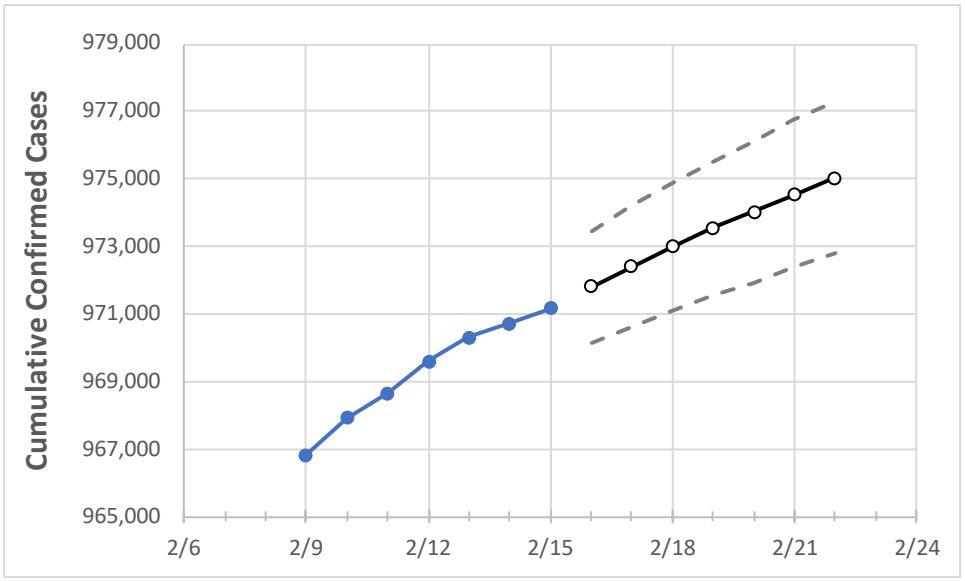
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Maryland	969,589	970,307	970,732	971,175	971,811	972,415	972,994	973,546	974,041	974,546	975,019

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Anne Arundel	85,717	85,784	85,817	85,878	85,945	86,007	86,065	86,125	86,179	86,233	86,286
Baltimore City	106,420	106,470	106,514	106,520	106,580	106,634	106,687	106,731	106,784	106,832	106,874
Baltimore County	126,425	126,515	126,556	126,607	126,685	126,755	126,817	126,882	126,942	127,003	127,056
Charles	26,774	26,800	26,815	27,393	27,461	27,527	27,578	27,628	27,694	27,766	27,821
Frederick	43,640	43,656	43,675	44,676	44,805	44,890	45,012	45,119	45,210	45,326	45,451
Harford	36,663	36,680	36,704	36,722	36,753	36,782	36,812	36,839	36,866	36,890	36,915
Howard	41,621	41,646	41,664	41,764	41,816	41,865	41,913	41,957	42,006	42,050	42,096
Montgomery	160,040	160,109	160,171	163,917	164,306	164,707	165,013	165,390	165,709	166,133	166,393
Prince George's	163,516	163,555	163,568	168,082	168,641	169,088	169,602	169,859	170,461	170,979	171,343

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:											
	2/12	2/13	2/14	2/15	2/17				2/19				2/21			
Anne Arundel	85,717	85,784	85,817	85,878	86,007	(17,201)	[4,128]	{2,064}	86,125	(17,225)	[4,134]	{2,067}	86,233	(17,247)	[4,139]	{2,070}
Baltimore City	106,420	106,470	106,514	106,520	106,634	(21,327)	[5,118]	{2,559}	106,731	(21,346)	[5,123]	{2,562}	106,832	(21,366)	[5,128]	{2,564}
Baltimore County	126,425	126,515	126,556	126,607	126,755	(25,351)	[6,084]	{3,042}	126,882	(25,376)	[6,090]	{3,045}	127,003	(25,401)	[6,096]	{3,048}
Charles	26,774	26,800	26,815	27,393	27,527	(5,505)	[1,321]	{661}	27,628	(5,526)	[1,326]	{663}	27,766	(5,553)	[1,333]	{666}
Frederick	43,640	43,656	43,675	44,676	44,890	(8,978)	[2,155]	{1,077}	45,119	(9,024)	[2,166]	{1,083}	45,326	(9,065)	[2,176]	{1,088}
Harford	36,663	36,680	36,704	36,722	36,782	(7,356)	[1,766]	{883}	36,839	(7,368)	[1,768]	{884}	36,890	(7,378)	[1,771]	{885}
Howard	41,621	41,646	41,664	41,764	41,865	(8,373)	[2,010]	{1,005}	41,957	(8,391)	[2,014]	{1,007}	42,050	(8,410)	[2,018]	{1,009}
Montgomery	160,040	160,109	160,171	163,917	164,707	(32,941)	[7,906]	{3,953}	165,390	(33,078)	[7,939]	{3,969}	166,133	(33,227)	[7,974]	{3,987}
Prince George's	163,516	163,555	163,568	168,082	169,088	(33,818)	[8,116]	{4,058}	169,859	(33,972)	[8,153]	{4,077}	170,979	(34,196)	[8,207]	{4,103}

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.