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

Date: 4/23/21

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 4/23/21 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.

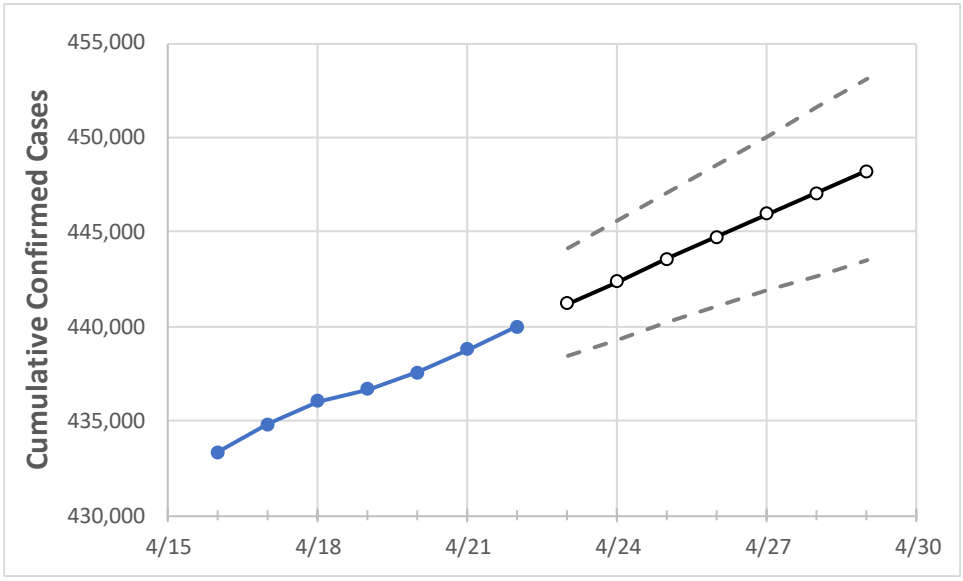
IEM's Modeling Lead

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Maryland	436,659	437,584	438,789	439,992	441,203	442,404	443,597	444,777	445,961	447,091	448,234

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Anne Arundel	41,386	41,463	41,610	41,743	41,867	41,991	42,114	42,240	42,367	42,494	42,616
Baltimore City	49,255	49,409	49,592	49,767	49,979	50,189	50,401	50,606	50,815	51,023	51,224
Baltimore County	61,095	61,278	61,567	61,847	62,120	62,397	62,668	62,935	63,208	63,477	63,752
Charles	10,296	10,328	10,359	10,377	10,401	10,424	10,447	10,470	10,493	10,516	10,539
Frederick	19,150	19,182	19,215	19,244	19,282	19,318	19,354	19,390	19,425	19,460	19,493
Harford	15,581	15,645	15,700	15,754	15,818	15,879	15,941	16,002	16,062	16,119	16,175
Howard	18,406	18,454	18,497	18,556	18,610	18,662	18,714	18,765	18,818	18,869	18,920
Montgomery	68,945	69,049	69,147	69,238	69,332	69,426	69,516	69,603	69,691	69,777	69,861
Prince George's	81,523	81,701	81,864	82,029	82,186	82,341	82,491	82,642	82,795	82,946	83,095

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:											
	4/19	4/20	4/21	4/22	4/24				4/26				4/28			
Anne Arundel	41,386	41,463	41,610	41,743	41,991	(8,398)	[2,016]	{1,008}	42,240	(8,448)	[2,028]	{1,014}	42,494	(8,499)	[2,040]	{1,020}
Baltimore City	49,255	49,409	49,592	49,767	50,189	(10,038)	[2,409]	{1,205}	50,606	(10,121)	[2,429]	{1,215}	51,023	(10,205)	[2,449]	{1,225}
Baltimore County	61,095	61,278	61,567	61,847	62,397	(12,479)	[2,995]	{1,498}	62,935	(12,587)	[3,021]	{1,510}	63,477	(12,695)	[3,047]	{1,523}
Charles	10,296	10,328	10,359	10,377	10,424	(2,085)	[500]	{250}	10,470	(2,094)	[503]	{251}	10,516	(2,103)	[505]	{252}
Frederick	19,150	19,182	19,215	19,244	19,318	(3,864)	[927]	{464}	19,390	(3,878)	[931]	{465}	19,460	(3,892)	[934]	{467}
Harford	15,581	15,645	15,700	15,754	15,879	(3,176)	[762]	{381}	16,002	(3,200)	[768]	{384}	16,119	(3,224)	[774]	{387}
Howard	18,406	18,454	18,497	18,556	18,662	(3,732)	[896]	{448}	18,765	(3,753)	[901]	{450}	18,869	(3,774)	[906]	{453}
Montgomery	68,945	69,049	69,147	69,238	69,426	(13,885)	[3,332]	{1,666}	69,603	(13,921)	[3,341]	{1,670}	69,777	(13,955)	[3,349]	{1,675}
Prince George's	81,523	81,701	81,864	82,029	82,341	(16,468)	[3,952]	{1,976}	82,642	(16,528)	[3,967]	{1,983}	82,946	(16,589)	[3,981]	{1,991}

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.