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

Date: 6/9/21

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 6/9/21 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.

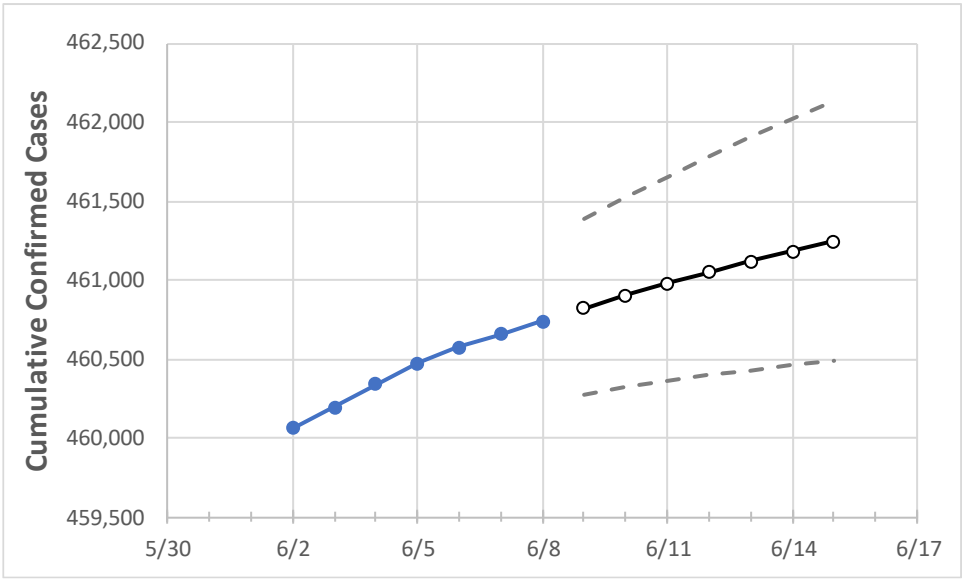
IEM's Modeling Lead

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Maryland	460,471	460,575	460,659	460,737	460,822	460,901	460,978	461,050	461,118	461,182	461,248

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Anne Arundel	43,825	43,832	43,841	43,848	43,855	43,863	43,869	43,875	43,881	43,887	43,892
Baltimore City	52,925	52,940	52,952	52,955	52,966	52,975	52,984	52,992	53,000	53,007	53,015
Baltimore County	65,709	65,726	65,735	65,753	65,765	65,776	65,786	65,795	65,804	65,812	65,820
Charles	10,891	10,892	10,898	10,899	10,903	10,906	10,910	10,913	10,917	10,920	10,923
Frederick	19,791	19,792	19,794	19,795	19,798	19,800	19,802	19,804	19,806	19,808	19,810
Harford	16,590	16,593	16,597	16,599	16,603	16,606	16,609	16,612	16,615	16,617	16,620
Howard	19,241	19,246	19,250	19,253	19,257	19,261	19,264	19,268	19,271	19,274	19,277
Montgomery	70,978	70,985	70,995	71,010	71,024	71,036	71,048	71,059	71,070	71,081	71,091
Prince George's	85,185	85,204	85,226	85,240	85,257	85,272	85,286	85,300	85,312	85,325	85,337

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:											
	6/5	6/6	6/7	6/8	6/10				6/12				6/14			
Anne Arundel	43,825	43,832	43,841	43,848	43,863	(8,773)	[2,105]	{1,053}	43,875	(8,775)	[2,106]	{1,053}	43,887	(8,777)	[2,107]	{1,053}
Baltimore City	52,925	52,940	52,952	52,955	52,975	(10,595)	[2,543]	{1,271}	52,992	(10,598)	[2,544]	{1,272}	53,007	(10,601)	[2,544]	{1,272}
Baltimore County	65,709	65,726	65,735	65,753	65,776	(13,155)	[3,157]	{1,579}	65,795	(13,159)	[3,158]	{1,579}	65,812	(13,162)	[3,159]	{1,579}
Charles	10,891	10,892	10,898	10,899	10,906	(2,181)	[524]	{262}	10,913	(2,183)	[524]	{262}	10,920	(2,184)	[524]	{262}
Frederick	19,791	19,792	19,794	19,795	19,800	(3,960)	[950]	{475}	19,804	(3,961)	[951]	{475}	19,808	(3,962)	[951]	{475}
Harford	16,590	16,593	16,597	16,599	16,606	(3,321)	[797]	{399}	16,612	(3,322)	[797]	{399}	16,617	(3,323)	[798]	{399}
Howard	19,241	19,246	19,250	19,253	19,261	(3,852)	[925]	{462}	19,268	(3,854)	[925]	{462}	19,274	(3,855)	[925]	{463}
Montgomery	70,978	70,985	70,995	71,010	71,036	(14,207)	[3,410]	{1,705}	71,059	(14,212)	[3,411]	{1,705}	71,081	(14,216)	[3,412]	{1,706}
Prince George's	85,185	85,204	85,226	85,240	85,272	(17,054)	[4,093]	{2,047}	85,300	(17,060)	[4,094]	{2,047}	85,325	(17,065)	[4,096]	{2,048}

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.