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

Date: 7/26/21

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 7/26/21 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.

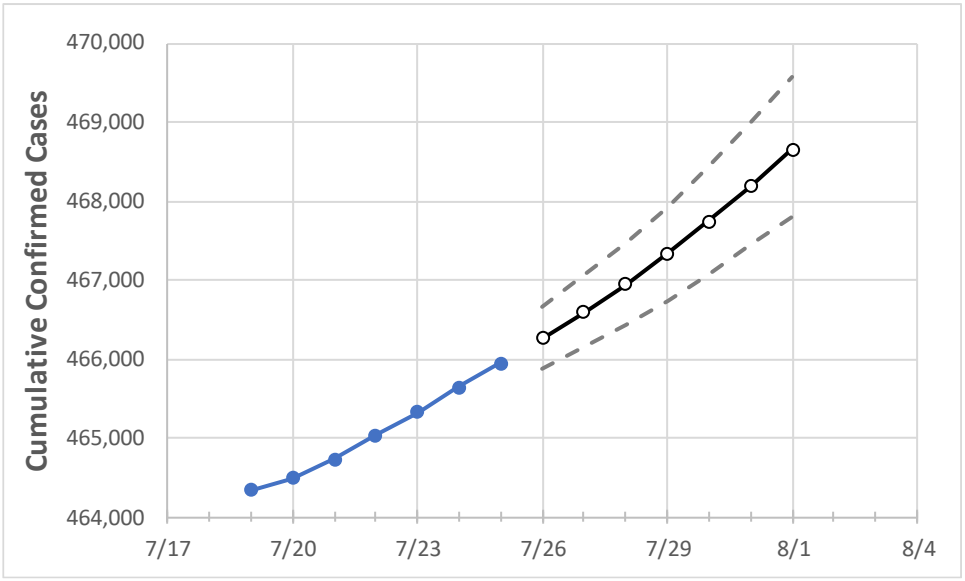
IEM's Modeling Lead

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:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
Maryland	465,038	465,326	465,643	465,949	466,260	466,593	466,950	467,336	467,745	468,183	468,653

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:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
Anne Arundel	44,245	44,284	44,318	44,343	44,376	44,412	44,450	44,490	44,534	44,581	44,631
Baltimore City	53,373	53,387	53,413	53,455	53,482	53,510	53,540	53,572	53,607	53,643	53,683
Baltimore County	66,252	66,296	66,335	66,370	66,404	66,440	66,478	66,520	66,565	66,611	66,661
Charles	11,066	11,077	11,088	11,100	11,112	11,125	11,139	11,154	11,170	11,188	11,207
Frederick	19,953	19,966	19,978	19,988	20,002	20,016	20,032	20,050	20,068	20,088	20,110
Harford	16,747	16,763	16,775	16,792	16,804	16,818	16,833	16,849	16,866	16,885	16,905
Howard	19,463	19,476	19,487	19,494	19,505	19,517	19,530	19,543	19,557	19,572	19,587
Montgomery	71,691	71,740	71,788	71,842	71,898	71,958	72,024	72,094	72,169	72,252	72,338
Prince George's	86,175	86,231	86,286	86,343	86,409	86,478	86,551	86,630	86,714	86,803	86,897

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:			
	7/22	7/23	7/24	7/25	7/27	7/29	7/31	
Anne Arundel	44,245	44,284	44,318	44,343	44,412 (8,882) [2,132] {1,066}	44,490 (8,898) [2,136] {1,068}	44,581 (8,916) [2,140] {1,070}	
Baltimore City	53,373	53,387	53,413	53,455	53,510 (10,702) [2,568] {1,284}	53,572 (10,714) [2,571] {1,286}	53,643 (10,729) [2,575] {1,287}	
Baltimore County	66,252	66,296	66,335	66,370	66,440 (13,288) [3,189] {1,595}	66,520 (13,304) [3,193] {1,596}	66,611 (13,322) [3,197] {1,599}	
Charles	11,066	11,077	11,088	11,100	11,125 (2,225) [534] {267}	11,154 (2,231) [535] {268}	11,188 (2,238) [537] {269}	
Frederick	19,953	19,966	19,978	19,988	20,016 (4,003) [961] {480}	20,050 (4,010) [962] {481}	20,088 (4,018) [964] {482}	
Harford	16,747	16,763	16,775	16,792	16,818 (3,364) [807] {404}	16,849 (3,370) [809] {404}	16,885 (3,377) [810] {405}	
Howard	19,463	19,476	19,487	19,494	19,517 (3,903) [937] {468}	19,543 (3,909) [938] {469}	19,572 (3,914) [939] {470}	
Montgomery	71,691	71,740	71,788	71,842	71,958 (14,392) [3,454] {1,727}	72,094 (14,419) [3,461] {1,730}	72,252 (14,450) [3,468] {1,734}	
Prince George's	86,175	86,231	86,286	86,343	86,478 (17,296) [4,151] {2,075}	86,630 (17,326) [4,158] {2,079}	86,803 (17,361) [4,167] {2,083}	

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.