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

Date: 7/14/21

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 7/14/21 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.

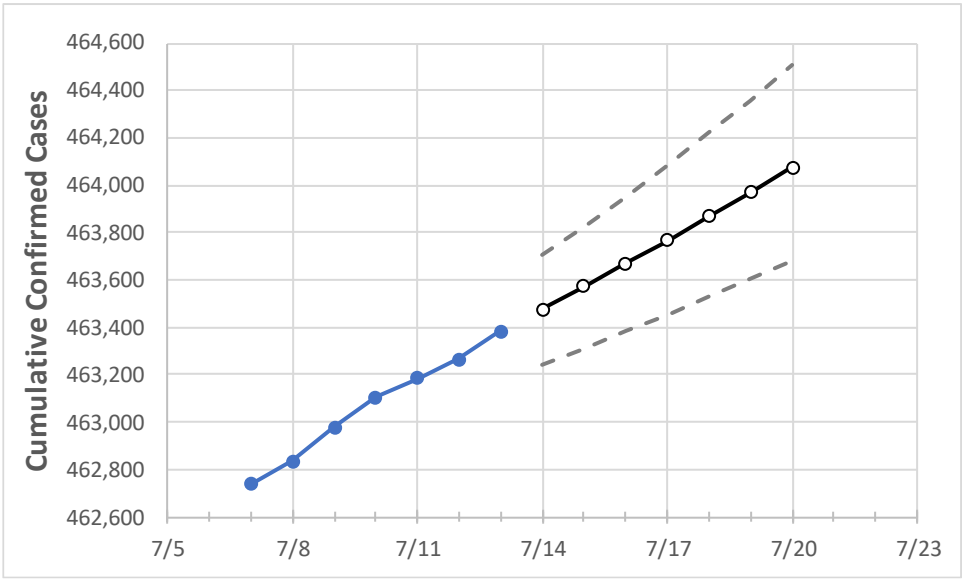
IEM's Modeling Lead

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Maryland	463,107	463,186	463,265	463,383	463,477	463,572	463,669	463,767	463,868	463,971	464,078

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Anne Arundel	44,045	44,056	44,065	44,074	44,083	44,091	44,100	44,110	44,119	44,129	44,139
Baltimore City	53,217	53,228	53,232	53,237	53,245	53,253	53,261	53,268	53,277	53,285	53,293
Baltimore County	66,048	66,059	66,069	66,074	66,083	66,092	66,101	66,110	66,119	66,127	66,136
Charles	10,989	10,992	10,998	11,004	11,007	11,010	11,013	11,016	11,019	11,022	11,025
Frederick	19,865	19,872	19,877	19,882	19,886	19,890	19,895	19,899	19,904	19,909	19,914
Harford	16,687	16,689	16,691	16,694	16,697	16,700	16,703	16,706	16,709	16,712	16,716
Howard	19,376	19,378	19,380	19,385	19,391	19,396	19,402	19,408	19,414	19,421	19,427
Montgomery	71,321	71,334	71,354	71,369	71,385	71,402	71,420	71,438	71,456	71,476	71,496
Prince George's	85,701	85,718	85,760	85,781	85,803	85,825	85,849	85,874	85,899	85,924	85,951

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:											
	7/10	7/11	7/12	7/13	7/15				7/17				7/19			
Anne Arundel	44,045	44,056	44,065	44,074	44,091	(8,818)	[2,116]	{1,058}	44,110	(8,822)	[2,117]	{1,059}	44,129	(8,826)	[2,118]	{1,059}
Baltimore City	53,217	53,228	53,232	53,237	53,253	(10,651)	[2,556]	{1,278}	53,268	(10,654)	[2,557]	{1,278}	53,285	(10,657)	[2,558]	{1,279}
Baltimore County	66,048	66,059	66,069	66,074	66,092	(13,218)	[3,172]	{1,586}	66,110	(13,222)	[3,173]	{1,587}	66,127	(13,225)	[3,174]	{1,587}
Charles	10,989	10,992	10,998	11,004	11,010	(2,202)	[528]	{264}	11,016	(2,203)	[529]	{264}	11,022	(2,204)	[529]	{265}
Frederick	19,865	19,872	19,877	19,882	19,890	(3,978)	[955]	{477}	19,899	(3,980)	[955]	{478}	19,909	(3,982)	[956]	{478}
Harford	16,687	16,689	16,691	16,694	16,700	(3,340)	[802]	{401}	16,706	(3,341)	[802]	{401}	16,712	(3,342)	[802]	{401}
Howard	19,376	19,378	19,380	19,385	19,396	(3,879)	[931]	{466}	19,408	(3,882)	[932]	{466}	19,421	(3,884)	[932]	{466}
Montgomery	71,321	71,334	71,354	71,369	71,402	(14,280)	[3,427]	{1,714}	71,438	(14,288)	[3,429]	{1,715}	71,476	(14,295)	[3,431]	{1,715}
Prince George's	85,701	85,718	85,760	85,781	85,825	(17,165)	[4,120]	{2,060}	85,874	(17,175)	[4,122]	{2,061}	85,924	(17,185)	[4,124]	{2,062}

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.