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

Date: 7/9/21

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 7/9/21 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.

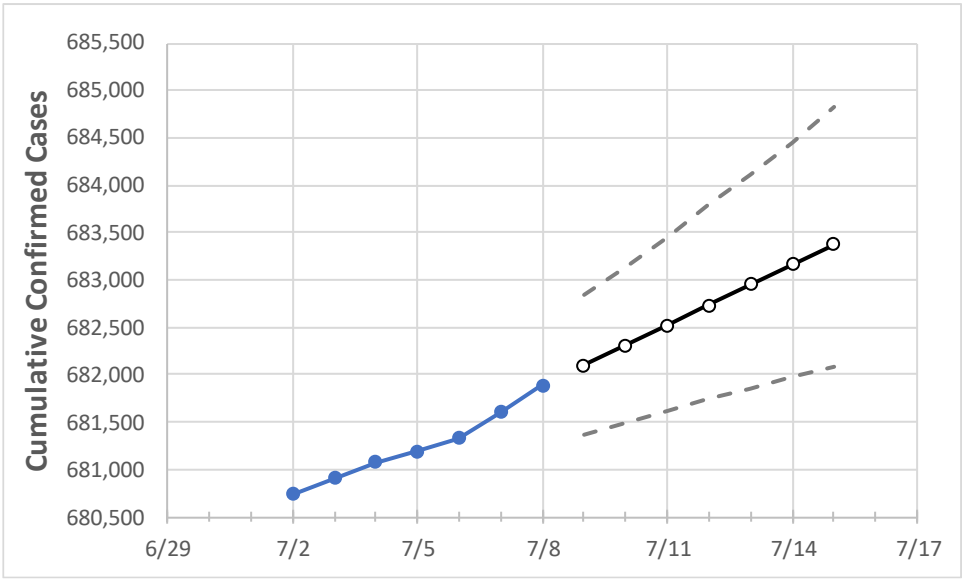
IEM's Modeling Lead

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.

Virginia State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Virginia	681,194	681,326	681,599	681,890	682,095	682,308	682,521	682,735	682,956	683,168	683,378

Note: The Commonwealth'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.

Virginia Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Alexandria City	11,895	11,900	11,903	11,916	11,921	11,926	11,932	11,938	11,945	11,952	11,959
Arlington	15,319	15,321	15,325	15,329	15,332	15,335	15,338	15,341	15,344	15,347	15,350
Fairfax	78,204	78,214	78,240	78,261	78,276	78,292	78,308	78,325	78,342	78,361	78,379
Henrico	26,016	26,075	26,034	26,018	26,076	26,139	26,208	26,283	26,366	26,451	26,547
James City	4,688	4,689	4,692	4,695	4,697	4,700	4,702	4,705	4,707	4,710	4,712
Loudoun	28,105	28,110	28,114	28,121	28,124	28,128	28,131	28,134	28,137	28,140	28,143
Prince William	51,371	51,386	51,400	51,413	51,421	51,428	51,436	51,444	51,451	51,458	51,465
Virginia Beach City	36,472	36,489	36,507	36,526	36,539	36,553	36,567	36,581	36,596	36,611	36,626

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.*

Virginia Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/5	7/6	7/7	7/8	7/10	7/12	7/14
Alexandria City	11,895	11,900	11,903	11,916	11,926 (2,385) [572] {286}	11,938 (2,388) [573] {287}	11,952 (2,390) [574] {287}
Arlington	15,319	15,321	15,325	15,329	15,335 (3,067) [736] {368}	15,341 (3,068) [736] {368}	15,347 (3,069) [737] {368}
Fairfax	78,204	78,214	78,240	78,261	78,292 (15,658) [3,758] {1,879}	78,325 (15,665) [3,760] {1,880}	78,361 (15,672) [3,761] {1,881}
Henrico	26,016	26,075	26,034	26,018	26,139 (5,228) [1,255] {627}	26,283 (5,257) [1,262] {631}	26,451 (5,290) [1,270] {635}
James City	4,688	4,689	4,692	4,695	4,700 (940) [226] {113}	4,705 (941) [226] {113}	4,710 (942) [226] {113}
Loudoun	28,105	28,110	28,114	28,121	28,128 (5,626) [1,350] {675}	28,134 (5,627) [1,350] {675}	28,140 (5,628) [1,351] {675}
Prince William	51,371	51,386	51,400	51,413	51,428 (10,286) [2,469] {1,234}	51,444 (10,289) [2,469] {1,235}	51,458 (10,292) [2,470] {1,235}
Virginia Beach City	36,472	36,489	36,507	36,526	36,553 (7,311) [1,755] {877}	36,581 (7,316) [1,756] {878}	36,611 (7,322) [1,757] {879}

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.