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

Date: 6/4/21

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 6/4/21 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.

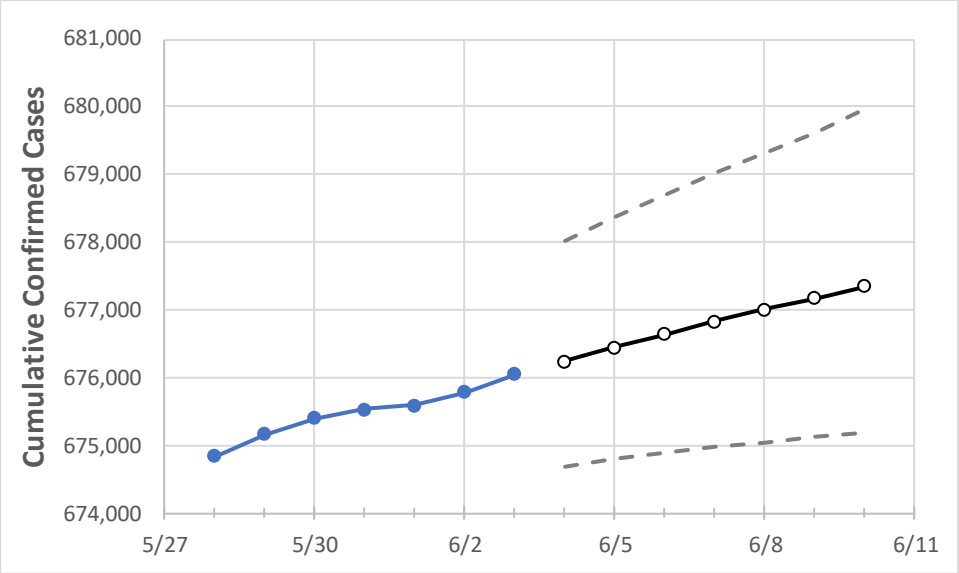
IEM's Modeling Lead

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:						
	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10
Virginia	675,538	675,597	675,783	676,041	676,245	676,446	676,644	676,835	677,014	677,176	677,342

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:						
	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10
Alexandria City	11,837	11,837	11,838	11,838	11,840	11,841	11,843	11,844	11,846	11,847	11,848
Arlington	15,292	15,291	15,294	15,294	15,296	15,298	15,299	15,301	15,302	15,304	15,305
Fairfax	78,003	78,008	78,009	78,009	78,021	78,034	78,044	78,055	78,065	78,075	78,084
Henrico	25,539	25,535	25,541	25,543	25,550	25,556	25,562	25,568	25,574	25,580	25,585
James City	4,642	4,641	4,642	4,644	4,647	4,649	4,652	4,655	4,657	4,660	4,662
Loudoun	27,923	27,940	27,954	27,954	27,960	27,965	27,971	27,976	27,981	27,985	27,990
Prince William	50,953	50,966	50,974	50,974	50,984	50,994	51,003	51,012	51,021	51,029	51,036
Virginia Beach City	36,181	36,190	36,193	36,205	36,216	36,226	36,235	36,244	36,254	36,262	36,271

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:		
	5/31	6/1	6/2	6/3	6/5	6/7	6/9
Alexandria City	11,837	11,837	11,838	11,838	11,841 (2,368) [568] {284}	11,844 (2,369) [569] {284}	11,847 (2,369) [569] {284}
Arlington	15,292	15,291	15,294	15,294	15,298 (3,060) [734] {367}	15,301 (3,060) [734] {367}	15,304 (3,061) [735] {367}
Fairfax	78,003	78,008	78,009	78,009	78,034 (15,607) [3,746] {1,873}	78,055 (15,611) [3,747] {1,873}	78,075 (15,615) [3,748] {1,874}
Henrico	25,539	25,535	25,541	25,543	25,556 (5,111) [1,227] {613}	25,568 (5,114) [1,227] {614}	25,580 (5,116) [1,228] {614}
James City	4,642	4,641	4,642	4,644	4,649 (930) [223] {112}	4,655 (931) [223] {112}	4,660 (932) [224] {112}
Loudoun	27,923	27,940	27,954	27,954	27,965 (5,593) [1,342] {671}	27,976 (5,595) [1,343] {671}	27,985 (5,597) [1,343] {672}
Prince William	50,953	50,966	50,974	50,974	50,994 (10,199) [2,448] {1,224}	51,012 (10,202) [2,449] {1,224}	51,029 (10,206) [2,449] {1,225}
Virginia Beach City	36,181	36,190	36,193	36,205	36,226 (7,245) [1,739] {869}	36,244 (7,249) [1,740] {870}	36,262 (7,252) [1,741] {870}

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.