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

Date: 4/21/21

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 4/21/21 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.

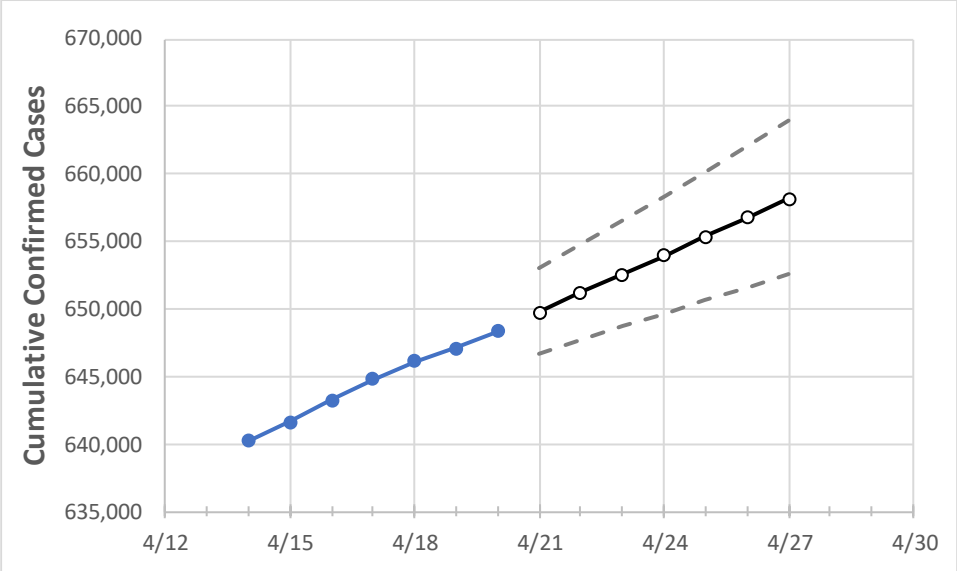
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Virginia	644,828	646,133	647,111	648,347	649,769	651,188	652,575	653,965	655,340	656,737	658,132

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Alexandria City	11,461	11,481	11,491	11,519	11,544	11,569	11,593	11,618	11,643	11,667	11,691
Arlington	14,835	14,846	14,861	14,884	14,905	14,925	14,944	14,963	14,981	14,999	15,016
Fairfax	75,449	75,565	75,662	75,796	75,939	76,081	76,218	76,354	76,490	76,624	76,755
Henrico	24,312	24,393	24,446	24,507	24,571	24,634	24,696	24,758	24,821	24,883	24,945
James City	4,453	4,460	4,466	4,470	4,479	4,488	4,497	4,505	4,513	4,522	4,530
Loudoun	26,694	26,736	26,795	26,849	26,916	26,982	27,048	27,113	27,178	27,243	27,306
Prince William	49,266	49,335	49,419	49,500	49,593	49,685	49,776	49,866	49,957	50,046	50,137
Virginia Beach City	34,507	34,588	34,650	34,740	34,820	34,901	34,981	35,060	35,141	35,220	35,301

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:		
	4/17	4/18	4/19	4/20	4/22	4/24	4/26
Alexandria City	11,461	11,481	11,491	11,519	11,569 (2,314) [555] {278}	11,618 (2,324) [558] {279}	11,667 (2,333) [560] {280}
Arlington	14,835	14,846	14,861	14,884	14,925 (2,985) [716] {358}	14,963 (2,993) [718] {359}	14,999 (3,000) [720] {360}
Fairfax	75,449	75,565	75,662	75,796	76,081 (15,216) [3,652] {1,826}	76,354 (15,271) [3,665] {1,833}	76,624 (15,325) [3,678] {1,839}
Henrico	24,312	24,393	24,446	24,507	24,634 (4,927) [1,182] {591}	24,758 (4,952) [1,188] {594}	24,883 (4,977) [1,194] {597}
James City	4,453	4,460	4,466	4,470	4,488 (898) [215] {108}	4,505 (901) [216] {108}	4,522 (904) [217] {109}
Loudoun	26,694	26,736	26,795	26,849	26,982 (5,396) [1,295] {648}	27,113 (5,423) [1,301] {651}	27,243 (5,449) [1,308] {654}
Prince William	49,266	49,335	49,419	49,500	49,685 (9,937) [2,385] {1,192}	49,866 (9,973) [2,394] {1,197}	50,046 (10,009) [2,402] {1,201}
Virginia Beach City	34,507	34,588	34,650	34,740	34,901 (6,980) [1,675] {838}	35,060 (7,012) [1,683] {841}	35,220 (7,044) [1,691] {845}

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.