IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/28/22

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 <u>not</u> 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 1/28/22 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
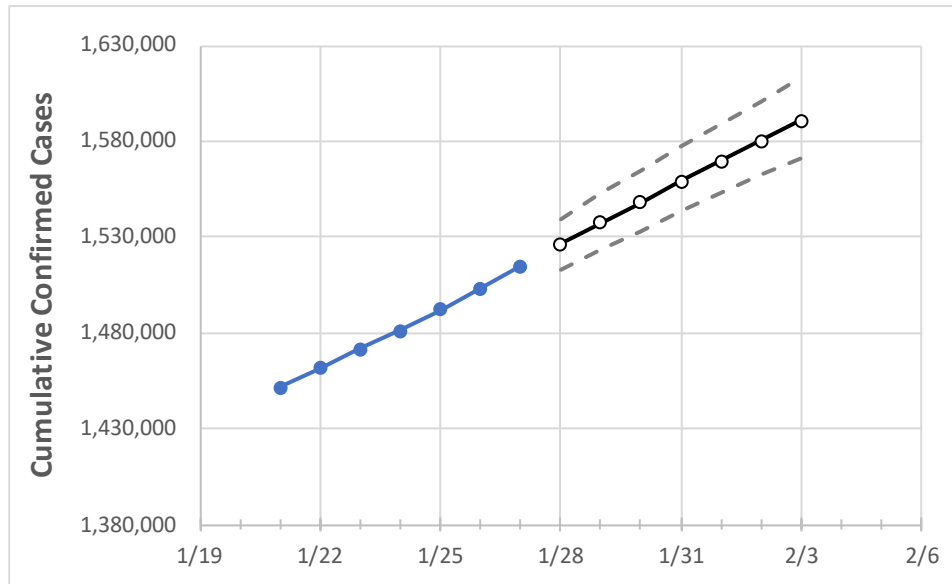
	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Virginia	1,481,294	1,491,993	1,503,119	1,514,862	1,526,248	1,537,437	1,548,295	1,559,085	1,569,802	1,580,427	1,590,616

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Alexandria City	27,475	27,605	27,730	27,894	28,034	28,169	28,297	28,421	28,538	28,650	28,762
Arlington	37,024	37,215	37,390	37,609	37,827	38,028	38,225	38,419	38,610	38,786	38,955
Fairfax	165,354	166,259	167,055	167,837	168,729	169,580	170,408	171,201	171,974	172,710	173,434
Henrico	56,717	57,279	57,915	58,474	58,952	59,424	59,880	60,345	60,794	61,233	61,691
James City	13,004	13,128	13,256	13,406	13,538	13,671	13,794	13,915	14,035	14,156	14,274
Loudoun	60,750	61,102	61,419	61,667	61,989	62,305	62,601	62,897	63,181	63,455	63,721
Prince William	100,104	100,506	100,947	101,268	101,781	102,276	102,738	103,201	103,663	104,105	104,532
Virginia Beach City	82,279	82,637	83,072	83,697	84,446	85,173	85,882	86,590	87,296	87,971	88,634

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Alexandria City	27,475	27,605	27,730	27,894	28,169 (5,634) [1,352] {676}	28,421 (5,684) [1,364] {682}	28,650 (5,730) [1,375] {688}
Arlington	37,024	37,215	37,390	37,609	38,028 (7,606) [1,825] {913}	38,419 (7,684) [1,844] {922}	38,786 (7,757) [1,862] {931}
Fairfax	165,354	166,259	167,055	167,837	169,580 (33,916) [8,140] {4,070}	171,201 (34,240) [8,218] {4,109}	172,710 (34,542) [8,290] {4,145}
Henrico	56,717	57,279	57,915	58,474	59,424 (11,885) [2,852] {1,426}	60,345 (12,069) [2,897] {1,448}	61,233 (12,247) [2,939] {1,470}
James City	13,004	13,128	13,256	13,406	13,671 (2,734) [656] {328}	13,915 (2,783) [668] {334}	14,156 (2,831) [680] {340}
Loudoun	60,750	61,102	61,419	61,667	62,305 (12,461) [2,991] {1,495}	62,897 (12,579) [3,019] {1,510}	63,455 (12,691) [3,046] {1,523}
Prince William	100,104	100,506	100,947	101,268	102,276 (20,455) [4,909] {2,455}	103,201 (20,640) [4,954] {2,477}	104,105 (20,821) [4,997] {2,499}
Virginia Beach City	82,279	82,637	83,072	83,697	85,173 (17,035) [4,088] {2,044}	86,590 (17,318) [4,156] {2,078}	87,971 (17,594) [4,223] {2,111}

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.