IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/22/21

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 <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 4/22/21 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
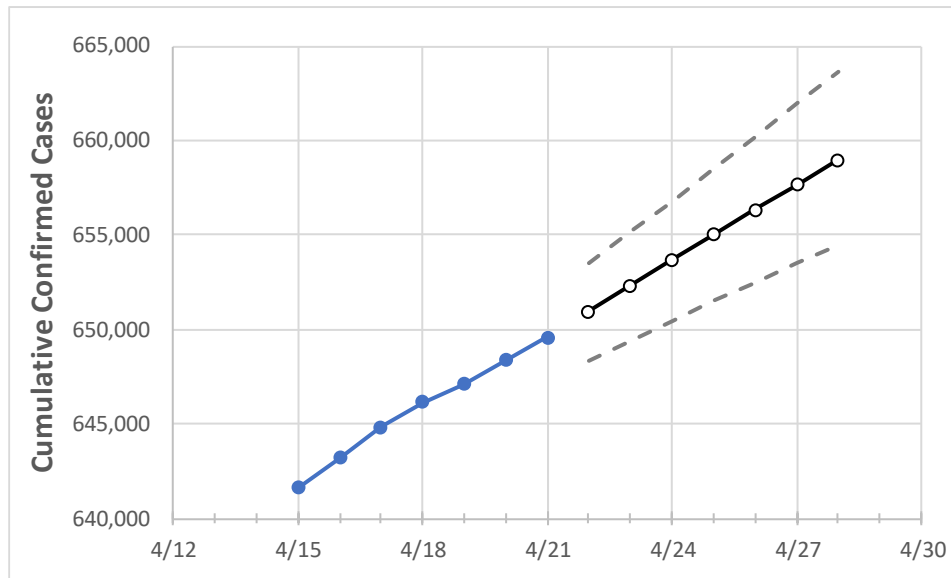
	Actual Confirmed Cases On:				Projected Cases For:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Virginia	646,133	647,111	648,347	649,608	650,978	652,332	653,707	655,036	656,355	657,680	658,971

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Alexandria City	11,481	11,491	11,519	11,522	11,544	11,566	11,588	11,610	11,631	11,652	11,673
Arlington	14,846	14,861	14,884	14,903	14,923	14,943	14,962	14,980	14,998	15,015	15,032
Fairfax	75,565	75,662	75,796	75,946	76,094	76,239	76,381	76,525	76,664	76,804	76,941
Henrico	24,393	24,446	24,507	24,553	24,612	24,671	24,728	24,787	24,844	24,900	24,956
James City	4,460	4,466	4,470	4,481	4,490	4,499	4,508	4,517	4,527	4,536	4,545
Loudoun	26,736	26,795	26,849	26,928	26,995	27,059	27,122	27,185	27,248	27,311	27,371
Prince William	49,335	49,419	49,500	49,573	49,670	49,769	49,867	49,962	50,057	50,153	50,247
Virginia Beach City	34,588	34,650	34,740	34,799	34,877	34,953	35,030	35,107	35,183	35,260	35,335

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:		
	4/18	4/19	4/20	4/21	4/23	4/25	4/27
Alexandria City	11,481	11,491	11,519	11,522	11,566 (2,313) [555] {278}	11,610 (2,322) [557] {279}	11,652 (2,330) [559] {280}
Arlington	14,846	14,861	14,884	14,903	14,943 (2,989) [717] {359}	14,980 (2,996) [719] {360}	15,015 (3,003) [721] {360}
Fairfax	75,565	75,662	75,796	75,946	76,239 (15,248) [3,659] {1,830}	76,525 (15,305) [3,673] {1,837}	76,804 (15,361) [3,687] {1,843}
Henrico	24,393	24,446	24,507	24,553	24,671 (4,934) [1,184] {592}	24,787 (4,957) [1,190] {595}	24,900 (4,980) [1,195] {598}
James City	4,460	4,466	4,470	4,481	4,499 (900) [216] {108}	4,517 (903) [217] {108}	4,536 (907) [218] {109}
Loudoun	26,736	26,795	26,849	26,928	27,059 (5,412) [1,299] {649}	27,185 (5,437) [1,305] {652}	27,311 (5,462) [1,311] {655}
Prince William	49,335	49,419	49,500	49,573	49,769 (9,954) [2,389] {1,194}	49,962 (9,992) [2,398] {1,199}	50,153 (10,031) [2,407] {1,204}
Virginia Beach City	34,588	34,650	34,740	34,799	34,953 (6,991) [1,678] {839}	35,107 (7,021) [1,685] {843}	35,260 (7,052) [1,693] {846}

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.