IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/10/21

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 11/10/21 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
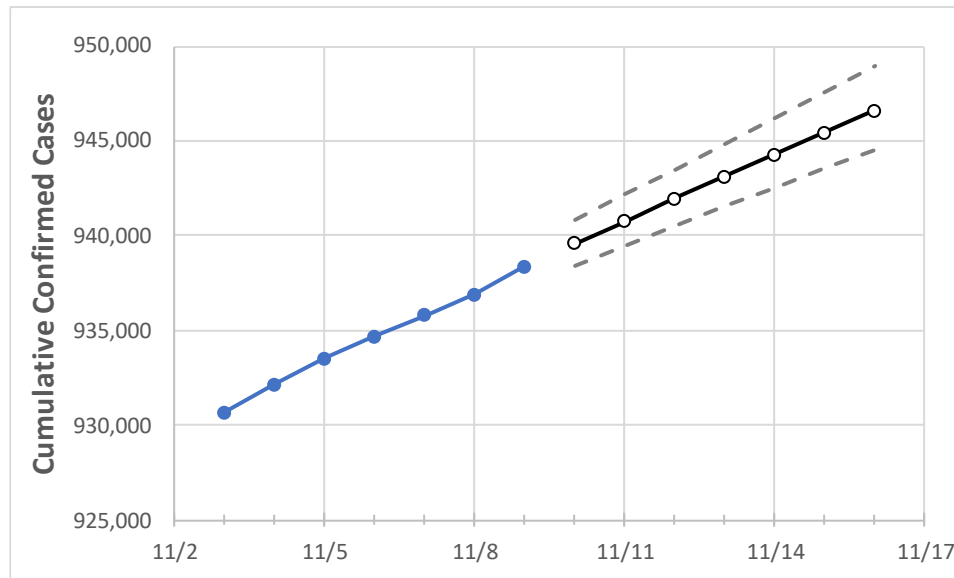
	Actual Confirmed Cases On:				Projected Cases For:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Virginia	934,671	935,799	936,928	938,376	939,584	940,777	941,958	943,129	944,289	945,456	946,598

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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Alexandria City	14,437	14,455	14,460	14,488	14,506	14,524	14,541	14,559	14,578	14,596	14,614
Arlington	18,824	18,853	18,892	18,915	18,941	18,967	18,994	19,021	19,048	19,075	19,103
Fairfax	93,920	93,990	94,066	94,193	94,276	94,357	94,437	94,519	94,598	94,680	94,758
Henrico	34,720	34,748	34,776	34,823	34,856	34,889	34,920	34,951	34,981	35,013	35,042
James City	7,095	7,109	7,123	7,137	7,152	7,167	7,182	7,197	7,212	7,227	7,243
Loudoun	34,514	34,544	34,594	34,655	34,694	34,735	34,773	34,814	34,853	34,893	34,932
Prince William	61,986	62,041	62,162	62,216	62,279	62,343	62,407	62,469	62,533	62,596	62,656
Virginia Beach City	50,107	50,146	50,185	50,268	50,317	50,364	50,411	50,460	50,507	50,553	50,601

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:		
	11/6	11/7	11/8	11/9	11/11	11/13	11/15
Alexandria City	14,437	14,455	14,460	14,488	14,524 (2,905) [697] {349}	14,559 (2,912) [699] {349}	14,596 (2,919) [701] {350}
Arlington	18,824	18,853	18,892	18,915	18,967 (3,793) [910] {455}	19,021 (3,804) [913] {456}	19,075 (3,815) [916] {458}
Fairfax	93,920	93,990	94,066	94,193	94,357 (18,871) [4,529] {2,265}	94,519 (18,904) [4,537] {2,268}	94,680 (18,936) [4,545] {2,272}
Henrico	34,720	34,748	34,776	34,823	34,889 (6,978) [1,675] {837}	34,951 (6,990) [1,678] {839}	35,013 (7,003) [1,681] {840}
James City	7,095	7,109	7,123	7,137	7,167 (1,433) [344] {172}	7,197 (1,439) [345] {173}	7,227 (1,445) [347] {173}
Loudoun	34,514	34,544	34,594	34,655	34,735 (6,947) [1,667] {834}	34,814 (6,963) [1,671] {836}	34,893 (6,979) [1,675] {837}
Prince William	61,986	62,041	62,162	62,216	62,343 (12,469) [2,992] {1,496}	62,469 (12,494) [2,999] {1,499}	62,596 (12,519) [3,005] {1,502}
Virginia Beach City	50,107	50,146	50,185	50,268	50,364 (10,073) [2,417] {1,209}	50,460 (10,092) [2,422] {1,211}	50,553 (10,111) [2,427] {1,213}

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.