IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/18/21

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 8/18/21 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
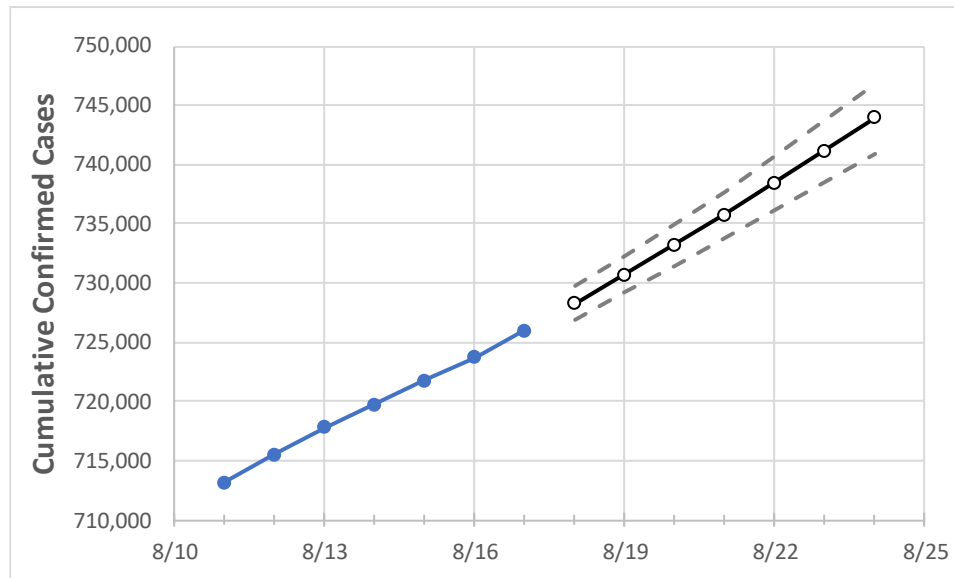
	Actual Confirmed Cases On:				Projected Cases For:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Virginia	719,793	721,760	723,727	725,971	728,317	730,732	733,238	735,814	738,463	741,168	743,969

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:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Alexandria City	12,430	12,450	12,480	12,490	12,513	12,537	12,561	12,585	12,611	12,638	12,664
Arlington	16,068	16,099	16,136	16,164	16,201	16,239	16,277	16,316	16,356	16,397	16,438
Fairfax	81,295	81,427	81,599	81,749	81,912	82,077	82,248	82,424	82,606	82,792	82,985
Henrico	27,557	27,660	27,762	27,848	27,952	28,059	28,173	28,291	28,415	28,542	28,677
James City	5,042	5,065	5,089	5,124	5,155	5,188	5,223	5,261	5,301	5,343	5,387
Loudoun	29,381	29,414	29,459	29,529	29,587	29,646	29,707	29,768	29,833	29,899	29,965
Prince William	53,243	53,312	53,423	53,545	53,651	53,762	53,876	53,994	54,116	54,240	54,367
Virginia Beach City	39,089	39,233	39,376	39,596	39,785	39,984	40,193	40,417	40,649	40,893	41,145

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:		
	8/14	8/15	8/16	8/17	8/19	8/21	8/23
Alexandria City	12,430	12,450	12,480	12,490	12,537 (2,507) [602] {301}	12,585 (2,517) [604] {302}	12,638 (2,528) [607] {303}
Arlington	16,068	16,099	16,136	16,164	16,239 (3,248) [779] {390}	16,316 (3,263) [783] {392}	16,397 (3,279) [787] {394}
Fairfax	81,295	81,427	81,599	81,749	82,077 (16,415) [3,940] {1,970}	82,424 (16,485) [3,956] {1,978}	82,792 (16,558) [3,974] {1,987}
Henrico	27,557	27,660	27,762	27,848	28,059 (5,612) [1,347] {673}	28,291 (5,658) [1,358] {679}	28,542 (5,708) [1,370] {685}
James City	5,042	5,065	5,089	5,124	5,188 (1,038) [249] {125}	5,261 (1,052) [253] {126}	5,343 (1,069) [256] {128}
Loudoun	29,381	29,414	29,459	29,529	29,646 (5,929) [1,423] {712}	29,768 (5,954) [1,429] {714}	29,899 (5,980) [1,435] {718}
Prince William	53,243	53,312	53,423	53,545	53,762 (10,752) [2,581] {1,290}	53,994 (10,799) [2,592] {1,296}	54,240 (10,848) [2,604] {1,302}
Virginia Beach City	39,089	39,233	39,376	39,596	39,984 (7,997) [1,919] {960}	40,417 (8,083) [1,940] {970}	40,893 (8,179) [1,963] {981}

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.