IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/3/21

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 9/3/21 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
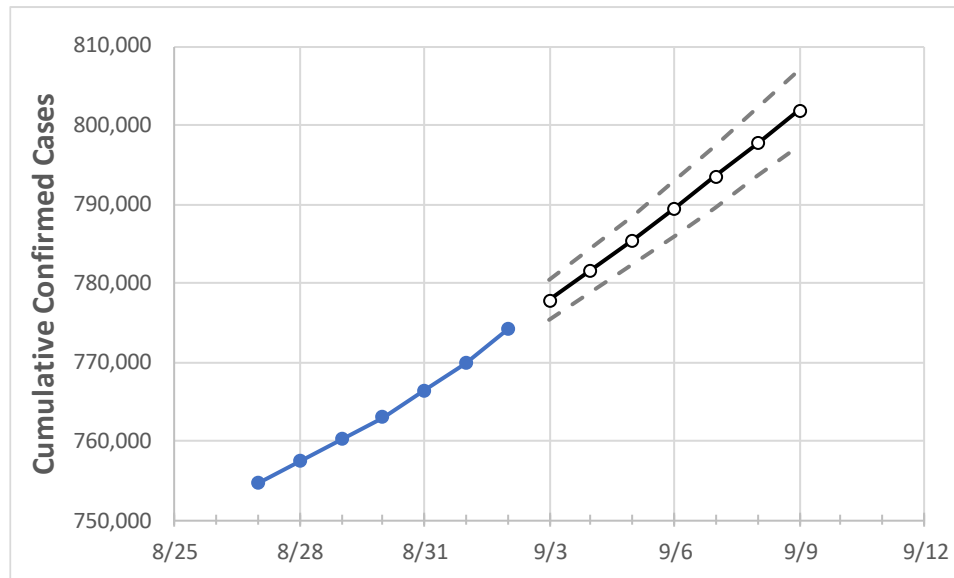
	Actual Confirmed Cases On:				Projected Cases For:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Virginia	762,948	766,435	769,842	774,097	777,763	781,630	785,434	789,420	793,467	797,638	801,925

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Alexandria City	12,817	12,848	12,885	12,918	12,947	12,975	13,005	13,034	13,064	13,095	13,126
Arlington	16,619	16,649	16,680	16,736	16,774	16,812	16,849	16,887	16,927	16,966	17,006
Fairfax	84,022	84,218	84,403	84,606	84,800	84,999	85,197	85,397	85,608	85,815	86,030
Henrico	29,357	29,472	29,581	29,714	29,850	29,988	30,128	30,269	30,415	30,564	30,718
James City	5,515	5,555	5,595	5,640	5,679	5,720	5,762	5,804	5,848	5,893	5,939
Loudoun	30,375	30,441	30,485	30,641	30,721	30,803	30,884	30,968	31,055	31,142	31,232
Prince William	54,873	55,020	55,135	55,274	55,396	55,522	55,647	55,776	55,903	56,038	56,172
Virginia Beach City	42,215	42,470	42,649	42,842	43,077	43,319	43,561	43,806	44,061	44,322	44,584

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Alexandria City	12,817	12,848	12,885	12,918	12,975 (2,595) [623] {311}	13,034 (2,607) [626] {313}	13,095 (2,619) [629] {314}
Arlington	16,619	16,649	16,680	16,736	16,812 (3,362) [807] {403}	16,887 (3,377) [811] {405}	16,966 (3,393) [814] {407}
Fairfax	84,022	84,218	84,403	84,606	84,999 (17,000) [4,080] {2,040}	85,397 (17,079) [4,099] {2,050}	85,815 (17,163) [4,119] {2,060}
Henrico	29,357	29,472	29,581	29,714	29,988 (5,998) [1,439] {720}	30,269 (6,054) [1,453] {726}	30,564 (6,113) [1,467] {734}
James City	5,515	5,555	5,595	5,640	5,720 (1,144) [275] {137}	5,804 (1,161) [279] {139}	5,893 (1,179) [283] {141}
Loudoun	30,375	30,441	30,485	30,641	30,803 (6,161) [1,479] {739}	30,968 (6,194) [1,486] {743}	31,142 (6,228) [1,495] {747}
Prince William	54,873	55,020	55,135	55,274	55,522 (11,104) [2,665] {1,333}	55,776 (11,155) [2,677] {1,339}	56,038 (11,208) [2,690] {1,345}
Virginia Beach City	42,215	42,470	42,649	42,842	43,319 (8,664) [2,079] {1,040}	43,806 (8,761) [2,103] {1,051}	44,322 (8,864) [2,127] {1,064}

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.