IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/11/21

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 not 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 5/11/21 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
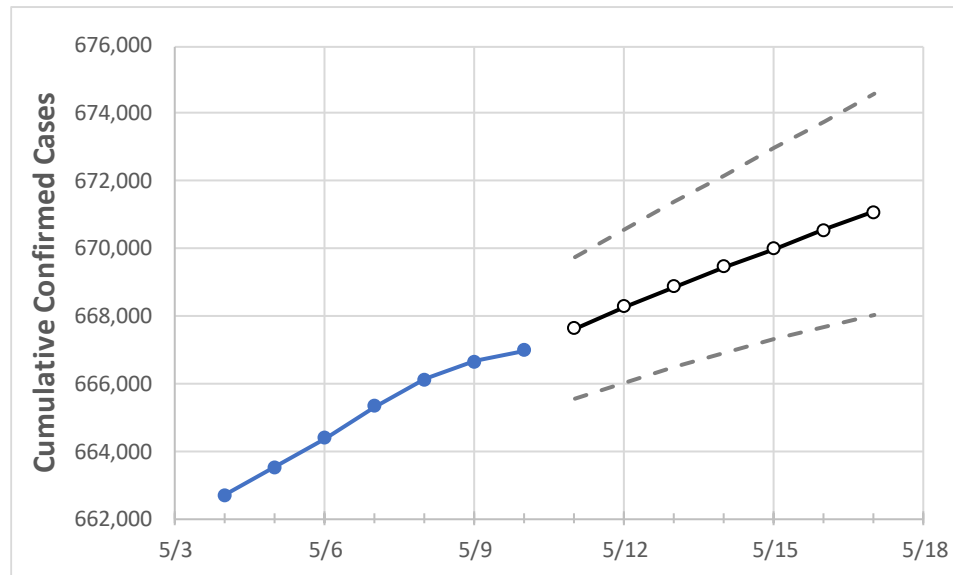
	Actual Confirmed Cases On:				Projected Cases For:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Virginia	665,332	666,111	666,650	666,986	667,635	668,270	668,868	669,453	670,007	670,549	671,090

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Alexandria City	11,735	11,752	11,754	11,759	11,767	11,776	11,784	11,792	11,799	11,806	11,813
Arlington	15,214	15,226	15,231	15,239	15,251	15,262	15,273	15,285	15,295	15,305	15,315
Fairfax	77,358	77,400	77,422	77,446	77,494	77,540	77,584	77,624	77,666	77,705	77,741
Henrico	25,163	25,191	25,219	25,234	25,256	25,277	25,298	25,317	25,336	25,355	25,372
James City	4,580	4,583	4,586	4,589	4,593	4,597	4,601	4,605	4,609	4,612	4,616
Loudoun	27,614	27,635	27,655	27,686	27,716	27,744	27,772	27,799	27,825	27,850	27,875
Prince William	50,501	50,549	50,561	50,577	50,613	50,647	50,680	50,712	50,742	50,772	50,800
Virginia Beach City	35,673	35,709	35,735	35,756	35,788	35,818	35,847	35,876	35,904	35,930	35,955

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:		
	5/7	5/8	5/9	5/10	5/12	5/14	5/16
Alexandria City	11,735	11,752	11,754	11,759	11,776 (2,355) [565] {283}	11,792 (2,358) [566] {283}	11,806 (2,361) [567] {283}
Arlington	15,214	15,226	15,231	15,239	15,262 (3,052) [733] {366}	15,285 (3,057) [734] {367}	15,305 (3,061) [735] {367}
Fairfax	77,358	77,400	77,422	77,446	77,540 (15,508) [3,722] {1,861}	77,624 (15,525) [3,726] {1,863}	77,705 (15,541) [3,730] {1,865}
Henrico	25,163	25,191	25,219	25,234	25,277 (5,055) [1,213] {607}	25,317 (5,063) [1,215] {608}	25,355 (5,071) [1,217] {609}
James City	4,580	4,583	4,586	4,589	4,597 (919) [221] {110}	4,605 (921) [221] {111}	4,612 (922) [221] {111}
Loudoun	27,614	27,635	27,655	27,686	27,744 (5,549) [1,332] {666}	27,799 (5,560) [1,334] {667}	27,850 (5,570) [1,337] {668}
Prince William	50,501	50,549	50,561	50,577	50,647 (10,129) [2,431] {1,216}	50,712 (10,142) [2,434] {1,217}	50,772 (10,154) [2,437] {1,219}
Virginia Beach City	35,673	35,709	35,735	35,756	35,818 (7,164) [1,719] {860}	35,876 (7,175) [1,722] {861}	35,930 (7,186) [1,725] {862}

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.