IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/25/21

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 5/25/21 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
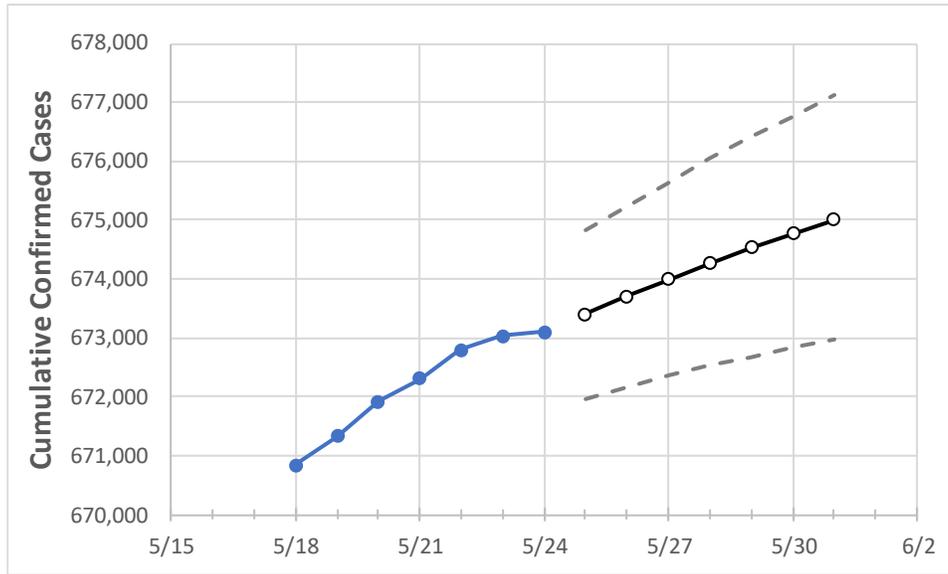
	Actual Confirmed Cases On:				Projected Cases For:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Virginia	672,312	672,793	673,029	673,105	673,412	673,713	673,996	674,270	674,531	674,778	675,006

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Alexandria City	11,822	11,825	11,827	11,832	11,836	11,839	11,842	11,845	11,848	11,851	11,853
Arlington	15,289	15,288	15,287	15,287	15,290	15,292	15,294	15,296	15,298	15,300	15,302
Fairfax	77,820	77,844	77,837	77,856	77,877	77,897	77,915	77,934	77,951	77,968	77,982
Henrico	25,433	25,457	25,473	25,480	25,493	25,505	25,516	25,527	25,539	25,549	25,559
James City	4,615	4,617	4,618	4,621	4,623	4,626	4,628	4,630	4,632	4,634	4,636
Loudoun	27,860	27,862	27,864	27,873	27,881	27,888	27,895	27,901	27,906	27,912	27,917
Prince William	50,808	50,834	50,836	50,854	50,871	50,887	50,903	50,918	50,932	50,946	50,959
Virginia Beach City	36,025	36,041	36,053	36,052	36,066	36,080	36,093	36,105	36,117	36,128	36,139

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:		
	5/21	5/22	5/23	5/24	5/26	5/28	5/30
Alexandria City	11,822	11,825	11,827	11,832	11,839 (2,368) [568] {284}	11,845 (2,369) [569] {284}	11,851 (2,370) [569] {284}
Arlington	15,289	15,288	15,287	15,287	15,292 (3,058) [734] {367}	15,296 (3,059) [734] {367}	15,300 (3,060) [734] {367}
Fairfax	77,820	77,844	77,837	77,856	77,897 (15,579) [3,739] {1,870}	77,934 (15,587) [3,741] {1,870}	77,968 (15,594) [3,742] {1,871}
Henrico	25,433	25,457	25,473	25,480	25,505 (5,101) [1,224] {612}	25,527 (5,105) [1,225] {613}	25,549 (5,110) [1,226] {613}
James City	4,615	4,617	4,618	4,621	4,626 (925) [222] {111}	4,630 (926) [222] {111}	4,634 (927) [222] {111}
Loudoun	27,860	27,862	27,864	27,873	27,888 (5,578) [1,339] {669}	27,901 (5,580) [1,339] {670}	27,912 (5,582) [1,340] {670}
Prince William	50,808	50,834	50,836	50,854	50,887 (10,177) [2,443] {1,221}	50,918 (10,184) [2,444] {1,222}	50,946 (10,189) [2,445] {1,223}
Virginia Beach City	36,025	36,041	36,053	36,052	36,080 (7,216) [1,732] {866}	36,105 (7,221) [1,733] {867}	36,128 (7,226) [1,734] {867}

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.