IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/11/21

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 <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 2/11/21 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
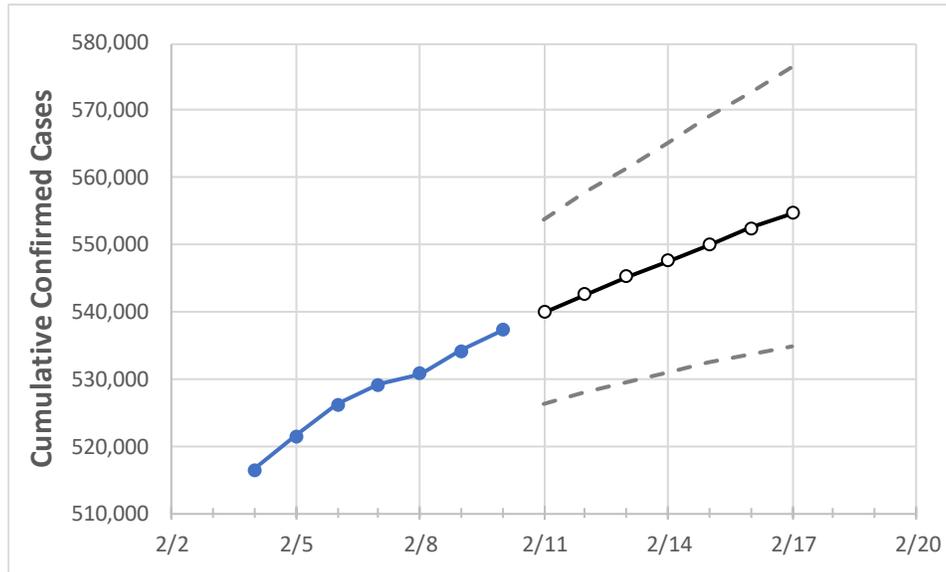
	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Virginia	529,125	530,825	534,116	537,319	540,000	542,643	545,177	547,627	550,049	552,428	554,680

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Alexandria City	9,744	9,778	9,798	9,846	9,875	9,903	9,930	9,957	9,984	10,010	10,034
Arlington	12,262	12,306	12,364	12,440	12,501	12,563	12,624	12,682	12,740	12,798	12,855
Fairfax	62,502	62,730	63,211	63,623	63,878	64,125	64,351	64,580	64,799	65,015	65,229
Henrico	19,546	19,627	19,760	19,862	19,980	20,096	20,210	20,320	20,428	20,535	20,643
James City	3,602	3,626	3,633	3,649	3,662	3,674	3,685	3,695	3,705	3,715	3,723
Loudoun	21,564	21,723	21,808	21,897	22,004	22,104	22,204	22,297	22,384	22,466	22,550
Prince William	41,585	41,858	42,151	42,416	42,599	42,779	42,951	43,115	43,278	43,433	43,583
Virginia Beach City	27,762	27,866	28,090	28,219	28,399	28,575	28,748	28,916	29,083	29,236	29,390

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:		
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Alexandria City	9,744	9,778	9,798	9,846	9,903 (1,981) [475] {238}	9,957 (1,991) [478] {239}	10,010 (2,002) [481] {240}
Arlington	12,262	12,306	12,364	12,440	12,563 (2,513) [603] {302}	12,682 (2,536) [609] {304}	12,798 (2,560) [614] {307}
Fairfax	62,502	62,730	63,211	63,623	64,125 (12,825) [3,078] {1,539}	64,580 (12,916) [3,100] {1,550}	65,015 (13,003) [3,121] {1,560}
Henrico	19,546	19,627	19,760	19,862	20,096 (4,019) [965] {482}	20,320 (4,064) [975] {488}	20,535 (4,107) [986] {493}
James City	3,602	3,626	3,633	3,649	3,674 (735) [176] {88}	3,695 (739) [177] {89}	3,715 (743) [178] {89}
Loudoun	21,564	21,723	21,808	21,897	22,104 (4,421) [1,061] {530}	22,297 (4,459) [1,070] {535}	22,466 (4,493) [1,078] {539}
Prince William	41,585	41,858	42,151	42,416	42,779 (8,556) [2,053] {1,027}	43,115 (8,623) [2,070] {1,035}	43,433 (8,687) [2,085] {1,042}
Virginia Beach City	27,762	27,866	28,090	28,219	28,575 (5,715) [1,372] {686}	28,916 (5,783) [1,388] {694}	29,236 (5,847) [1,403] {702}

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.