IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/26/21

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 2/26/21 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.

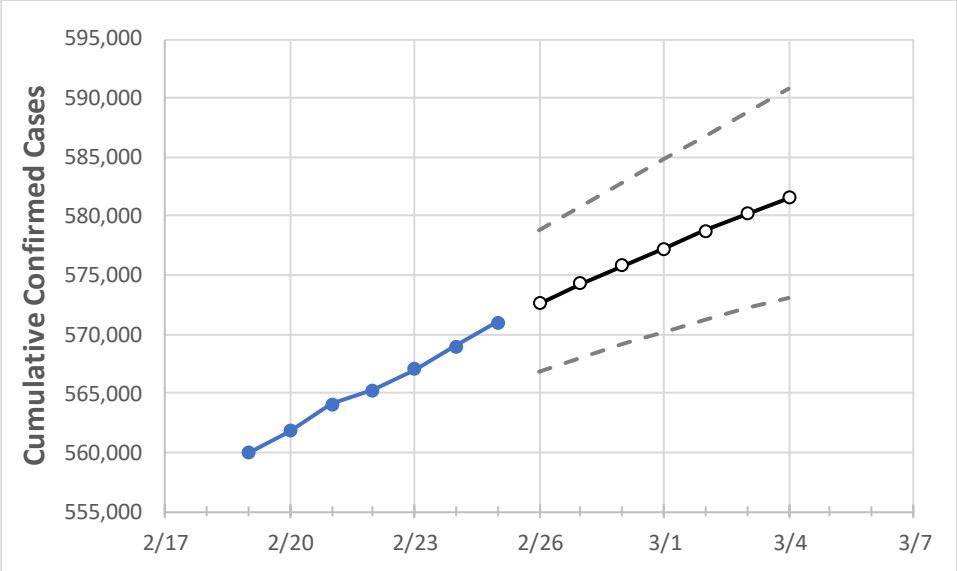
IEM's Modeling Lead

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Virginia	565,270	567,039	568,946	570,982	572,603	574,269	575,824	577,292	578,762	580,178	581,527

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Alexandria City	10,210	10,229	10,259	10,259	10,281	10,302	10,323	10,344	10,365	10,384	10,403
Arlington	12,922	12,974	13,020	13,020	13,053	13,087	13,118	13,149	13,181	13,211	13,241
Fairfax	66,290	66,542	66,798	66,798	66,976	67,150	67,326	67,491	67,661	67,821	67,980
Henrico	20,950	21,040	21,098	21,186	21,251	21,314	21,375	21,434	21,489	21,544	21,596
James City	3,806	3,815	3,819	3,828	3,836	3,843	3,851	3,858	3,865	3,871	3,877
Loudoun	22,762	22,816	22,873	22,873	22,917	22,959	22,998	23,037	23,072	23,106	23,139
Prince William	43,919	44,007	44,134	44,134	44,225	44,313	44,397	44,475	44,553	44,628	44,699
Virginia Beach City	29,876	30,051	30,161	30,310	30,421	30,527	30,630	30,731	30,830	30,924	31,015

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:		
	2/22	2/23	2/24	2/25	2/27	3/1	3/3
Alexandria City	10,210	10,229	10,259	10,259	10,302 (2,060) [495] {247}	10,344 (2,069) [496] {248}	10,384 (2,077) [498] {249}
Arlington	12,922	12,974	13,020	13,020	13,087 (2,617) [628] {314}	13,149 (2,630) [631] {316}	13,211 (2,642) [634] {317}
Fairfax	66,290	66,542	66,798	66,798	67,150 (13,430) [3,223] {1,612}	67,491 (13,498) [3,240] {1,620}	67,821 (13,564) [3,255] {1,628}
Henrico	20,950	21,040	21,098	21,186	21,314 (4,263) [1,023] {512}	21,434 (4,287) [1,029] {514}	21,544 (4,309) [1,034] {517}
James City	3,806	3,815	3,819	3,828	3,843 (769) [184] {92}	3,858 (772) [185] {93}	3,871 (774) [186] {93}
Loudoun	22,762	22,816	22,873	22,873	22,959 (4,592) [1,102] {551}	23,037 (4,607) [1,106] {553}	23,106 (4,621) [1,109] {555}
Prince William	43,919	44,007	44,134	44,134	44,313 (8,863) [2,127] {1,064}	44,475 (8,895) [2,135] {1,067}	44,628 (8,926) [2,142] {1,071}
Virginia Beach City	29,876	30,051	30,161	30,310	30,527 (6,105) [1,465] {733}	30,731 (6,146) [1,475] {738}	30,924 (6,185) [1,484] {742}

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.