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

Date: 5/6/21

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 5/6/21 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.

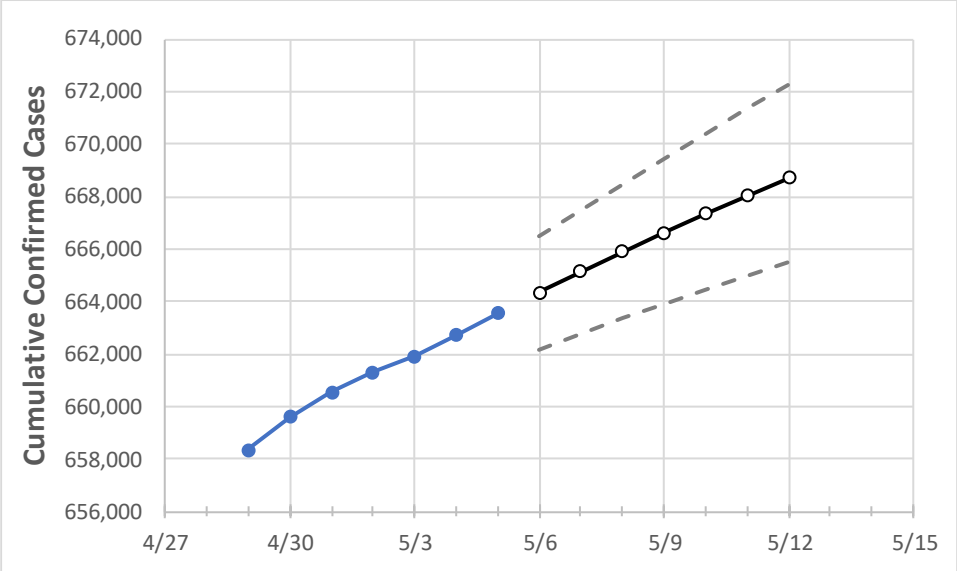
IEM's Modeling Lead

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:						
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12
Virginia	661,314	661,925	662,696	663,538	664,344	665,130	665,894	666,617	667,337	668,011	668,693

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:						
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12
Alexandria City	11,683	11,692	11,700	11,713	11,723	11,733	11,743	11,753	11,762	11,771	11,779
Arlington	15,130	15,143	15,156	15,171	15,186	15,200	15,214	15,228	15,241	15,255	15,268
Fairfax	76,968	77,019	77,121	77,169	77,232	77,294	77,352	77,407	77,461	77,513	77,562
Henrico	25,038	25,067	25,097	25,130	25,163	25,195	25,226	25,256	25,284	25,312	25,340
James City	4,556	4,558	4,566	4,569	4,574	4,579	4,584	4,588	4,593	4,597	4,601
Loudoun	27,411	27,442	27,483	27,539	27,574	27,609	27,642	27,674	27,705	27,735	27,765
Prince William	50,222	50,268	50,310	50,345	50,384	50,420	50,456	50,490	50,523	50,555	50,584
Virginia Beach City	35,470	35,510	35,544	35,590	35,636	35,681	35,725	35,767	35,809	35,849	35,888

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:		
	5/2	5/3	5/4	5/5	5/7	5/9	5/11
Alexandria City	11,683	11,692	11,700	11,713	11,733 (2,347) [563] {282}	11,753 (2,351) [564] {282}	11,771 (2,354) [565] {283}
Arlington	15,130	15,143	15,156	15,171	15,200 (3,040) [730] {365}	15,228 (3,046) [731] {365}	15,255 (3,051) [732] {366}
Fairfax	76,968	77,019	77,121	77,169	77,294 (15,459) [3,710] {1,855}	77,407 (15,481) [3,716] {1,858}	77,513 (15,503) [3,721] {1,860}
Henrico	25,038	25,067	25,097	25,130	25,195 (5,039) [1,209] {605}	25,256 (5,051) [1,212] {606}	25,312 (5,062) [1,215] {607}
James City	4,556	4,558	4,566	4,569	4,579 (916) [220] {110}	4,588 (918) [220] {110}	4,597 (919) [221] {110}
Loudoun	27,411	27,442	27,483	27,539	27,609 (5,522) [1,325] {663}	27,674 (5,535) [1,328] {664}	27,735 (5,547) [1,331] {666}
Prince William	50,222	50,268	50,310	50,345	50,420 (10,084) [2,420] {1,210}	50,490 (10,098) [2,424] {1,212}	50,555 (10,111) [2,427] {1,213}
Virginia Beach City	35,470	35,510	35,544	35,590	35,681 (7,136) [1,713] {856}	35,767 (7,153) [1,717] {858}	35,849 (7,170) [1,721] {860}

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.