

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

Date: 2/23/22

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 2/23/22 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.

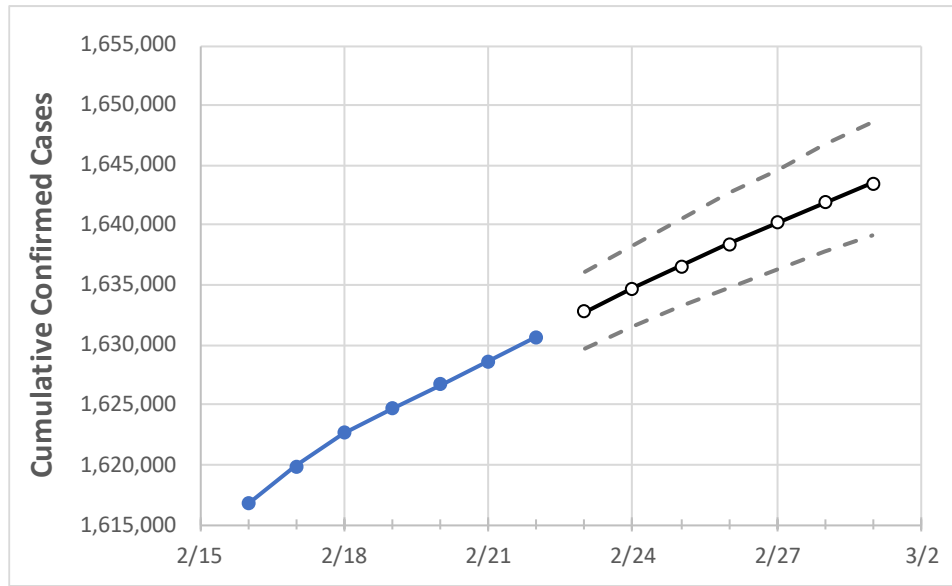
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Virginia	1,624,684	1,626,684	1,628,683	1,630,682	1,632,755	1,634,749	1,636,617	1,638,449	1,640,193	1,641,890	1,643,463

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Alexandria City	29,390	29,412	29,434	29,454	29,478	29,501	29,522	29,544	29,563	29,583	29,600
Arlington	39,869	39,927	39,985	40,002	40,051	40,099	40,144	40,189	40,233	40,277	40,318
Fairfax	175,470	175,609	175,747	175,912	176,030	176,143	176,255	176,357	176,457	176,554	176,641
Henrico	62,648	62,729	62,810	62,891	62,963	63,032	63,098	63,161	63,223	63,282	63,337
James City	14,497	14,519	14,540	14,561	14,583	14,603	14,624	14,643	14,662	14,680	14,697
Loudoun	64,898	64,945	64,992	65,064	65,136	65,201	65,268	65,330	65,392	65,449	65,508
Prince William	105,660	105,783	105,906	106,000	106,125	106,243	106,364	106,480	106,595	106,715	106,819
Virginia Beach City	87,963	88,017	88,072	88,126	88,181	88,232	88,281	88,329	88,374	88,418	88,459

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Alexandria City	29,390	29,412	29,434	29,454	29,501	(5,900)	[1,416]	{708}	29,544	(5,909)	[1,418]	{709}	29,583	(5,917)	[1,420]	{710}
Arlington	39,869	39,927	39,985	40,002	40,099	(8,020)	[1,925]	{962}	40,189	(8,038)	[1,929]	{965}	40,277	(8,055)	[1,933]	{967}
Fairfax	175,470	175,609	175,747	175,912	176,143	(35,229)	[8,455]	{4,227}	176,357	(35,271)	[8,465]	{4,233}	176,554	(35,311)	[8,475]	{4,237}
Henrico	62,648	62,729	62,810	62,891	63,032	(12,606)	[3,026]	{1,513}	63,161	(12,632)	[3,032]	{1,516}	63,282	(12,656)	[3,038]	{1,519}
James City	14,497	14,519	14,540	14,561	14,603	(2,921)	[701]	{350}	14,643	(2,929)	[703]	{351}	14,680	(2,936)	[705]	{352}
Loudoun	64,898	64,945	64,992	65,064	65,201	(13,040)	[3,130]	{1,565}	65,330	(13,066)	[3,136]	{1,568}	65,449	(13,090)	[3,142]	{1,571}
Prince William	105,660	105,783	105,906	106,000	106,243	(21,249)	[5,100]	{2,550}	106,480	(21,296)	[5,111]	{2,556}	106,715	(21,343)	[5,122]	{2,561}
Virginia Beach City	87,963	88,017	88,072	88,126	88,232	(17,646)	[4,235]	{2,118}	88,329	(17,666)	[4,240]	{2,120}	88,418	(17,684)	[4,244]	{2,122}

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.