

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

Date: 1/24/22

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 1/24/22 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.

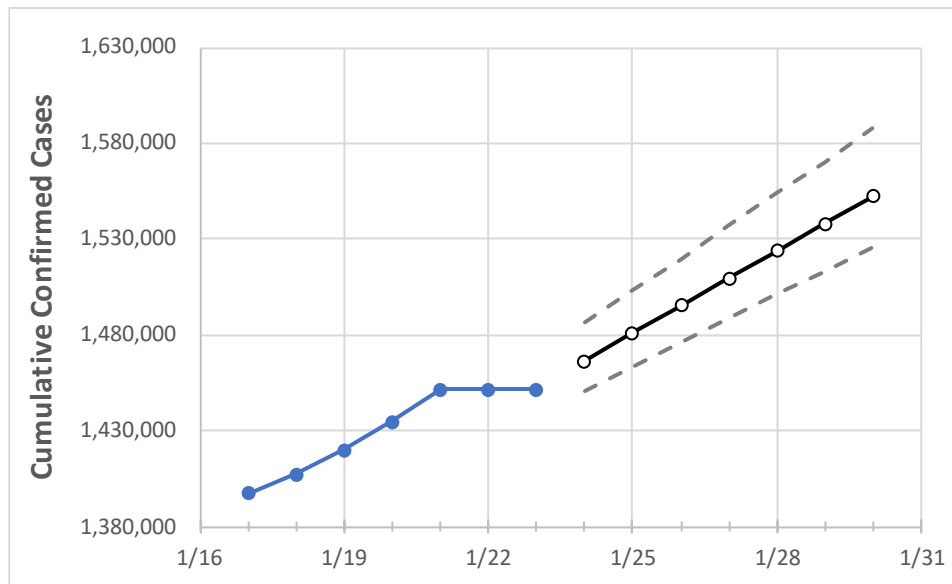
IEM's Modeling Lead

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:							
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	
Virginia	1,434,686	1,451,713	1,451,713	1,451,713	1,466,393	1,481,084	1,495,160	1,509,705	1,523,714	1,537,960	1,552,137	

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:							
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	
Alexandria City	26,871	27,032	27,192	27,353	27,551	27,741	27,922	28,093	28,268	28,427	28,589	
Arlington	36,218	36,414	36,610	36,806	37,109	37,393	37,675	37,934	38,200	38,456	38,703	
Fairfax	161,670	162,516	163,363	164,209	165,485	166,714	167,877	169,034	170,186	171,286	172,336	
Henrico	54,961	55,547	55,547	55,547	56,061	56,552	57,039	57,528	58,008	58,480	58,943	
James City	12,462	12,699	12,699	12,699	12,891	13,077	13,255	13,441	13,625	13,812	13,981	
Loudoun	59,462	59,730	59,999	60,267	60,667	61,062	61,425	61,791	62,140	62,478	62,808	
Prince William	97,918	98,365	98,812	99,259	99,931	100,586	101,215	101,823	102,436	103,008	103,582	
Virginia Beach City	79,419	80,392	80,392	80,392	81,387	82,376	83,366	84,334	85,319	86,293	87,279	

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:											
	1/20	1/21	1/22	1/23	1/25				1/27				1/29			
Alexandria City	26,871	27,032	27,192	27,353	27,741	(5,548)	[1,332]	{666}	28,093	(5,619)	[1,348]	{674}	28,427	(5,685)	[1,364]	{682}
Arlington	36,218	36,414	36,610	36,806	37,393	(7,479)	[1,795]	{897}	37,934	(7,587)	[1,821]	{910}	38,456	(7,691)	[1,846]	{923}
Fairfax	161,670	162,516	163,363	164,209	166,714	(33,343)	[8,002]	{4,001}	169,034	(33,807)	[8,114]	{4,057}	171,286	(34,257)	[8,222]	{4,111}
Henrico	54,961	55,547	55,547	55,547	56,552	(11,310)	[2,714]	{1,357}	57,528	(11,506)	[2,761]	{1,381}	58,480	(11,696)	[2,807]	{1,404}
James City	12,462	12,699	12,699	12,699	13,077	(2,615)	[628]	{314}	13,441	(2,688)	[645]	{323}	13,812	(2,762)	[663]	{331}
Loudoun	59,462	59,730	59,999	60,267	61,062	(12,212)	[2,931]	{1,465}	61,791	(12,358)	[2,966]	{1,483}	62,478	(12,496)	[2,999]	{1,499}
Prince William	97,918	98,365	98,812	99,259	100,586	(20,117)	[4,828]	{2,414}	101,823	(20,365)	[4,888]	{2,444}	103,008	(20,602)	[4,944]	{2,472}
Virginia Beach City	79,419	80,392	80,392	80,392	82,376	(16,475)	[3,954]	{1,977}	84,334	(16,867)	[4,048]	{2,024}	86,293	(17,259)	[4,142]	{2,071}

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.