

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

Date: 2/16/22

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 2/16/22 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.

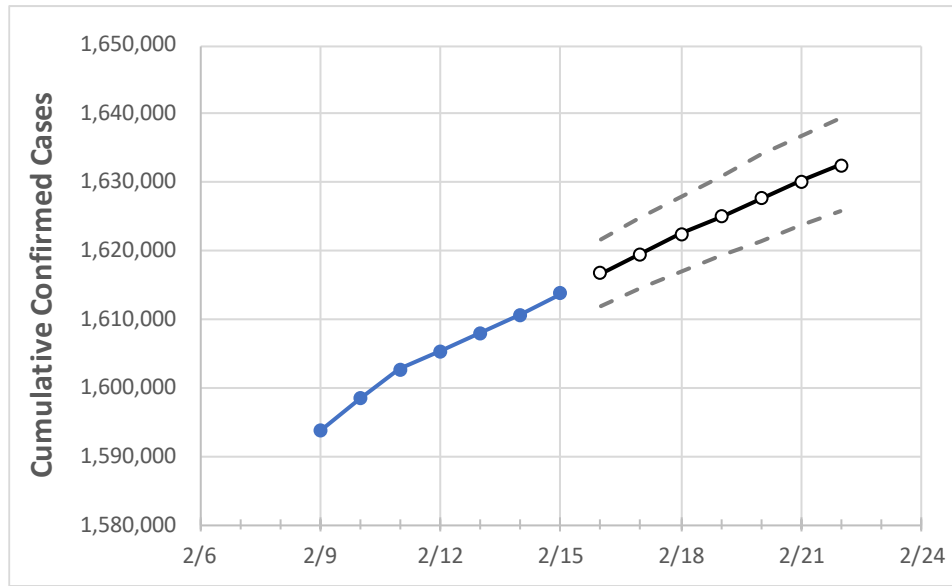
IEM's Modeling Lead

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Virginia	1,605,360	1,608,043	1,610,726	1,613,719	1,616,756	1,619,602	1,622,495	1,625,060	1,627,591	1,630,182	1,632,464	

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Alexandria City	29,168	29,204	29,234	29,267	29,304	29,340	29,373	29,406	29,437	29,468	29,496	
Arlington	39,399	39,453	39,512	39,587	39,652	39,715	39,770	39,830	39,882	39,939	39,986	
Fairfax	174,388	174,578	174,784	174,908	175,102	175,288	175,466	175,626	175,791	175,940	176,088	
Henrico	62,003	62,106	62,209	62,299	62,396	62,488	62,577	62,661	62,743	62,819	62,891	
James City	14,292	14,322	14,352	14,369	14,396	14,423	14,448	14,472	14,495	14,517	14,538	
Loudoun	64,233	64,324	64,466	64,610	64,713	64,818	64,914	65,015	65,110	65,200	65,289	
Prince William	104,507	104,616	104,808	105,019	105,146	105,279	105,401	105,519	105,635	105,745	105,849	
Virginia Beach City	87,388	87,477	87,565	87,660	87,741	87,818	87,891	87,961	88,028	88,088	88,146	

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:											
	2/12	2/13	2/14	2/15	2/17				2/19				2/21			
Alexandria City	29,168	29,204	29,234	29,267	29,340	(5,868)	[1,408]	{704}	29,406	(5,881)	[1,411]	{706}	29,468	(5,894)	[1,414]	{707}
Arlington	39,399	39,453	39,512	39,587	39,715	(7,943)	[1,906]	{953}	39,830	(7,966)	[1,912]	{956}	39,939	(7,988)	[1,917]	{959}
Fairfax	174,388	174,578	174,784	174,908	175,288	(35,058)	[8,414]	{4,207}	175,626	(35,125)	[8,430]	{4,215}	175,940	(35,188)	[8,445]	{4,223}
Henrico	62,003	62,106	62,209	62,299	62,488	(12,498)	[2,999]	{1,500}	62,661	(12,532)	[3,008]	{1,504}	62,819	(12,564)	[3,015]	{1,508}
James City	14,292	14,322	14,352	14,369	14,423	(2,885)	[692]	{346}	14,472	(2,894)	[695]	{347}	14,517	(2,903)	[697]	{348}
Loudoun	64,233	64,324	64,466	64,610	64,818	(12,964)	[3,111]	{1,556}	65,015	(13,003)	[3,121]	{1,560}	65,200	(13,040)	[3,130]	{1,565}
Prince William	104,507	104,616	104,808	105,019	105,279	(21,056)	[5,053]	{2,527}	105,519	(21,104)	[5,065]	{2,532}	105,745	(21,149)	[5,076]	{2,538}
Virginia Beach City	87,388	87,477	87,565	87,660	87,818	(17,564)	[4,215]	{2,108}	87,961	(17,592)	[4,222]	{2,111}	88,088	(17,618)	[4,228]	{2,114}

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.