

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/17/21**

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 12/17/21 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.

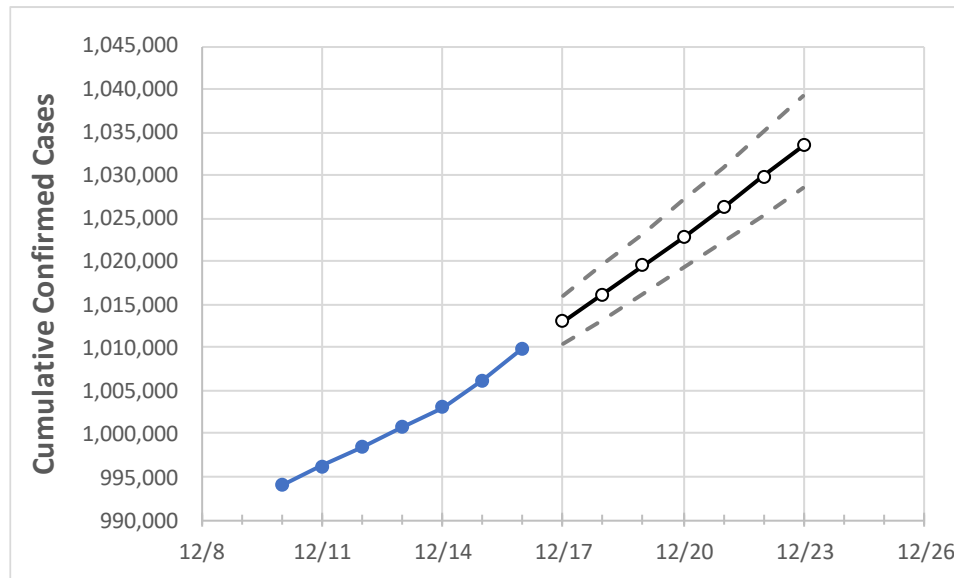
IEM's Modeling Lead

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Virginia	1,000,694	1,003,110	1,006,245	1,009,933	1,013,070	1,016,236	1,019,495	1,022,807	1,026,317	1,029,858	1,033,472

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Alexandria City	15,332	15,407	15,517	15,517	15,587	15,662	15,738	15,817	15,903	15,992	16,085
Arlington	20,360	20,448	20,616	20,616	20,723	20,836	20,952	21,075	21,204	21,339	21,483
Fairfax	99,740	100,075	100,399	100,399	100,684	100,976	101,270	101,572	101,887	102,214	102,553
Henrico	37,255	37,348	37,457	37,596	37,719	37,846	37,975	38,111	38,247	38,387	38,529
James City	7,654	7,672	7,682	7,696	7,714	7,731	7,748	7,765	7,784	7,801	7,819
Loudoun	37,530	37,708	37,893	37,893	38,061	38,233	38,412	38,596	38,789	38,982	39,184
Prince William	65,536	65,715	65,907	65,907	66,087	66,265	66,453	66,645	66,843	67,048	67,255
Virginia Beach City	52,738	52,841	52,970	53,121	53,248	53,377	53,509	53,642	53,786	53,928	54,074

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:											
	12/13	12/14	12/15	12/16	12/18				12/20				12/22			
Alexandria City	15,332	15,407	15,517	15,517	15,662	(3,132)	[752]	{376}	15,817	(3,163)	[759]	{380}	15,992	(3,198)	[768]	{384}
Arlington	20,360	20,448	20,616	20,616	20,836	(4,167)	[1,000]	{500}	21,075	(4,215)	[1,012]	{506}	21,339	(4,268)	[1,024]	{512}
Fairfax	99,740	100,075	100,399	100,399	100,976	(20,195)	[4,847]	{2,423}	101,572	(20,314)	[4,875]	{2,438}	102,214	(20,443)	[4,906]	{2,453}
Henrico	37,255	37,348	37,457	37,596	37,846	(7,569)	[1,817]	{908}	38,111	(7,622)	[1,829]	{915}	38,387	(7,677)	[1,843]	{921}
James City	7,654	7,672	7,682	7,696	7,731	(1,546)	[371]	{186}	7,765	(1,553)	[373]	{186}	7,801	(1,560)	[374]	{187}
Loudoun	37,530	37,708	37,893	37,893	38,233	(7,647)	[1,835]	{918}	38,596	(7,719)	[1,853]	{926}	38,982	(7,796)	[1,871]	{936}
Prince William	65,536	65,715	65,907	65,907	66,265	(13,253)	[3,181]	{1,590}	66,645	(13,329)	[3,199]	{1,599}	67,048	(13,410)	[3,218]	{1,609}
Virginia Beach City	52,738	52,841	52,970	53,121	53,377	(10,675)	[2,562]	{1,281}	53,642	(10,728)	[2,575]	{1,287}	53,928	(10,786)	[2,589]	{1,294}

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.