

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

Date: 3/23/21

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 3/23/21 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.

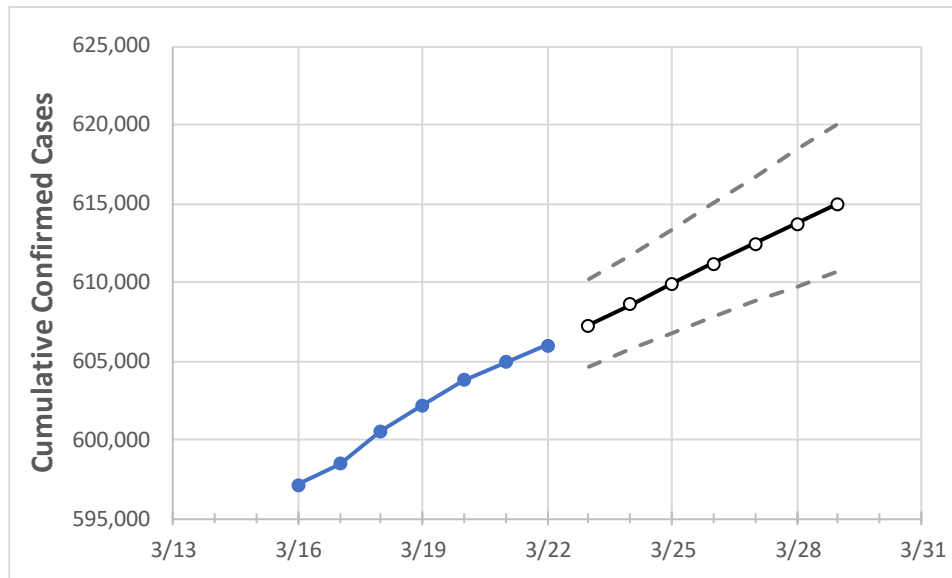
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Virginia	602,182	603,745	604,904	605,967	607,284	608,606	609,920	611,193	612,470	613,744	615,000

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Alexandria City	10,740	10,758	10,771	10,784	10,808	10,832	10,857	10,881	10,906	10,931	10,955
Arlington	13,856	13,882	13,897	13,915	13,943	13,971	13,998	14,025	14,052	14,078	14,105
Fairfax	70,587	70,741	70,860	70,983	71,132	71,282	71,430	71,582	71,733	71,881	72,031
Henrico	22,390	22,452	22,506	22,547	22,598	22,650	22,701	22,751	22,801	22,852	22,902
James City	4,082	4,085	4,113	4,124	4,137	4,150	4,164	4,177	4,190	4,204	4,219
Loudoun	24,491	24,552	24,603	24,659	24,741	24,824	24,907	24,991	25,076	25,163	25,253
Prince William	46,232	46,285	46,330	46,426	46,507	46,589	46,669	46,748	46,825	46,906	46,985
Virginia Beach City	32,207	32,303	32,361	32,465	32,547	32,628	32,708	32,788	32,867	32,949	33,027

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:											
	3/19	3/20	3/21	3/22	3/24				3/26				3/28			
Alexandria City	10,740	10,758	10,771	10,784	10,832	(2,166)	[520]	{260}	10,881	(2,176)	[522]	{261}	10,931	(2,186)	[525]	{262}
Arlington	13,856	13,882	13,897	13,915	13,971	(2,794)	[671]	{335}	14,025	(2,805)	[673]	{337}	14,078	(2,816)	[676]	{338}
Fairfax	70,587	70,741	70,860	70,983	71,282	(14,256)	[3,422]	{1,711}	71,582	(14,316)	[3,436]	{1,718}	71,881	(14,376)	[3,450]	{1,725}
Henrico	22,390	22,452	22,506	22,547	22,650	(4,530)	[1,087]	{544}	22,751	(4,550)	[1,092]	{546}	22,852	(4,570)	[1,097]	{548}
James City	4,082	4,085	4,113	4,124	4,150	(830)	[199]	{100}	4,177	(835)	[200]	{100}	4,204	(841)	[202]	{101}
Loudoun	24,491	24,552	24,603	24,659	24,824	(4,965)	[1,192]	{596}	24,991	(4,998)	[1,200]	{600}	25,163	(5,033)	[1,208]	{604}
Prince William	46,232	46,285	46,330	46,426	46,589	(9,318)	[2,236]	{1,118}	46,748	(9,350)	[2,244]	{1,122}	46,906	(9,381)	[2,251]	{1,126}
Virginia Beach City	32,207	32,303	32,361	32,465	32,628	(6,526)	[1,566]	{783}	32,788	(6,558)	[1,574]	{787}	32,949	(6,590)	[1,582]	{791}

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.