

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 3/17/21**

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 3/17/21 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.

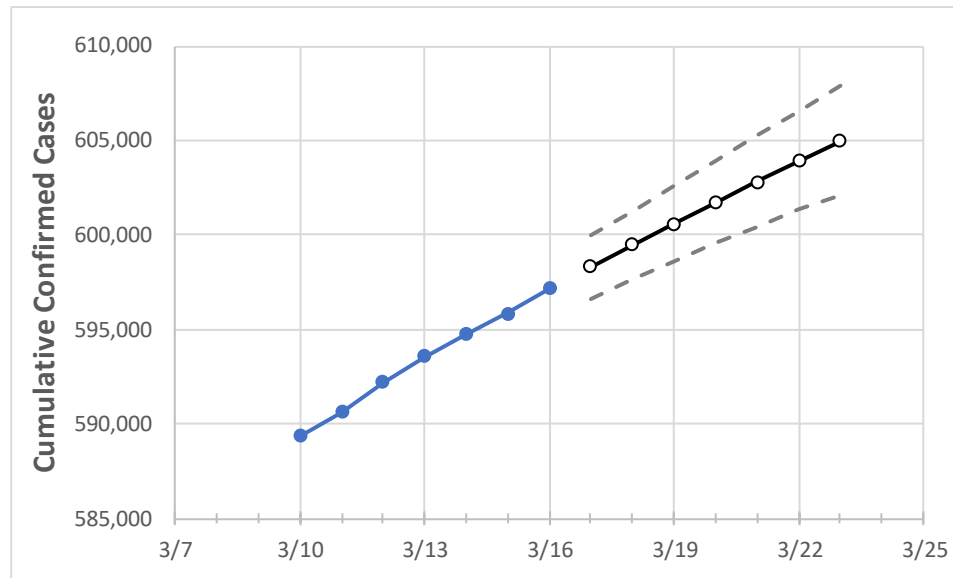
IEM's Modeling Lead

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Virginia	593,562	594,735	595,865	597,141	598,313	599,467	600,586	601,720	602,823	603,925	604,975

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Alexandria City	10,570	10,592	10,617	10,643	10,660	10,678	10,695	10,713	10,730	10,746	10,763
Arlington	13,638	13,655	13,683	13,729	13,760	13,790	13,820	13,848	13,878	13,906	13,934
Fairfax	69,513	69,628	69,771	69,918	70,046	70,173	70,295	70,413	70,531	70,647	70,759
Henrico	22,069	22,122	22,155	22,203	22,249	22,292	22,335	22,377	22,419	22,460	22,500
James City	3,995	4,010	4,028	4,039	4,051	4,063	4,075	4,087	4,098	4,110	4,122
Loudoun	23,928	23,986	24,060	24,197	24,266	24,336	24,407	24,479	24,552	24,627	24,701
Prince William	45,613	45,689	45,768	45,859	45,930	45,997	46,064	46,128	46,192	46,254	46,318
Virginia Beach City	31,725	31,793	31,848	31,937	32,011	32,084	32,156	32,225	32,294	32,363	32,429

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:											
	3/13	3/14	3/15	3/16	3/18				3/20				3/22			
Alexandria City	10,570	10,592	10,617	10,643	10,678	(2,136)	[513]	{256}	10,713	(2,143)	[514]	{257}	10,746	(2,149)	[516]	{258}
Arlington	13,638	13,655	13,683	13,729	13,790	(2,758)	[662]	{331}	13,848	(2,770)	[665]	{332}	13,906	(2,781)	[667]	{334}
Fairfax	69,513	69,628	69,771	69,918	70,173	(14,035)	[3,368]	{1,684}	70,413	(14,083)	[3,380]	{1,690}	70,647	(14,129)	[3,391]	{1,696}
Henrico	22,069	22,122	22,155	22,203	22,292	(4,458)	[1,070]	{535}	22,377	(4,475)	[1,074]	{537}	22,460	(4,492)	[1,078]	{539}
James City	3,995	4,010	4,028	4,039	4,063	(813)	[195]	{98}	4,087	(817)	[196]	{98}	4,110	(822)	[197]	{99}
Loudoun	23,928	23,986	24,060	24,197	24,336	(4,867)	[1,168]	{584}	24,479	(4,896)	[1,175]	{587}	24,627	(4,925)	[1,182]	{591}
Prince William	45,613	45,689	45,768	45,859	45,997	(9,199)	[2,208]	{1,104}	46,128	(9,226)	[2,214]	{1,107}	46,254	(9,251)	[2,220]	{1,110}
Virginia Beach City	31,725	31,793	31,848	31,937	32,084	(6,417)	[1,540]	{770}	32,225	(6,445)	[1,547]	{773}	32,363	(6,473)	[1,553]	{777}

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.