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

Date: 2/16/21

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 2/16/21 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.

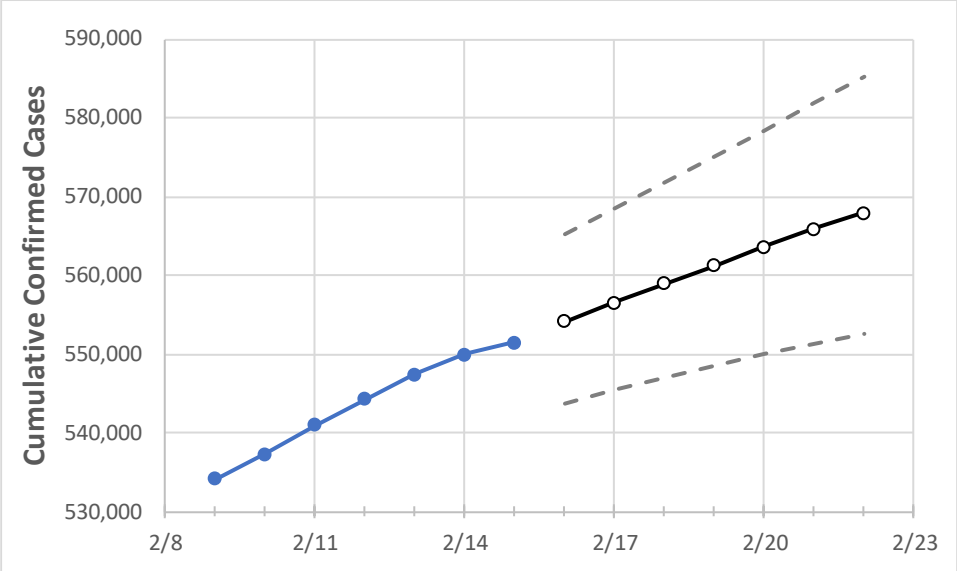
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Virginia	544,209	547,424	549,999	551,538	554,096	556,575	558,936	561,258	563,601	565,867	567,982

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	9,946	9,985	10,006	10,037	10,066	10,095	10,121	10,148	10,174	10,201	10,225
Arlington	12,550	12,589	12,611	12,653	12,704	12,752	12,800	12,848	12,894	12,938	12,982
Fairfax	64,326	64,588	64,756	64,950	65,198	65,427	65,654	65,883	66,103	66,320	66,517
Henrico	20,108	20,249	20,315	20,392	20,492	20,591	20,688	20,782	20,873	20,964	21,050
James City	3,666	3,684	3,708	3,721	3,731	3,741	3,750	3,759	3,767	3,774	3,782
Loudoun	22,102	22,186	22,246	22,310	22,392	22,475	22,555	22,626	22,698	22,762	22,823
Prince William	42,771	42,909	42,997	43,104	43,255	43,400	43,538	43,677	43,815	43,944	44,067
Virginia Beach City	28,608	28,796	28,975	29,081	29,240	29,395	29,543	29,693	29,837	29,977	30,112

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	9,946	9,985	10,006	10,037	10,095 (2,019) [485] {242}	10,148 (2,030) [487] {244}	10,201 (2,040) [490] {245}
Arlington	12,550	12,589	12,611	12,653	12,752 (2,550) [612] {306}	12,848 (2,570) [617] {308}	12,938 (2,588) [621] {311}
Fairfax	64,326	64,588	64,756	64,950	65,427 (13,085) [3,140] {1,570}	65,883 (13,177) [3,162] {1,581}	66,320 (13,264) [3,183] {1,592}
Henrico	20,108	20,249	20,315	20,392	20,591 (4,118) [988] {494}	20,782 (4,156) [998] {499}	20,964 (4,193) [1,006] {503}
James City	3,666	3,684	3,708	3,721	3,741 (748) [180] {90}	3,759 (752) [180] {90}	3,774 (755) [181] {91}
Loudoun	22,102	22,186	22,246	22,310	22,475 (4,495) [1,079] {539}	22,626 (4,525) [1,086] {543}	22,762 (4,552) [1,093] {546}
Prince William	42,771	42,909	42,997	43,104	43,400 (8,680) [2,083] {1,042}	43,677 (8,735) [2,096] {1,048}	43,944 (8,789) [2,109] {1,055}
Virginia Beach City	28,608	28,796	28,975	29,081	29,395 (5,879) [1,411] {705}	29,693 (5,939) [1,425] {713}	29,977 (5,995) [1,439] {719}

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.