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

Date: 3/19/21

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 3/19/21 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.

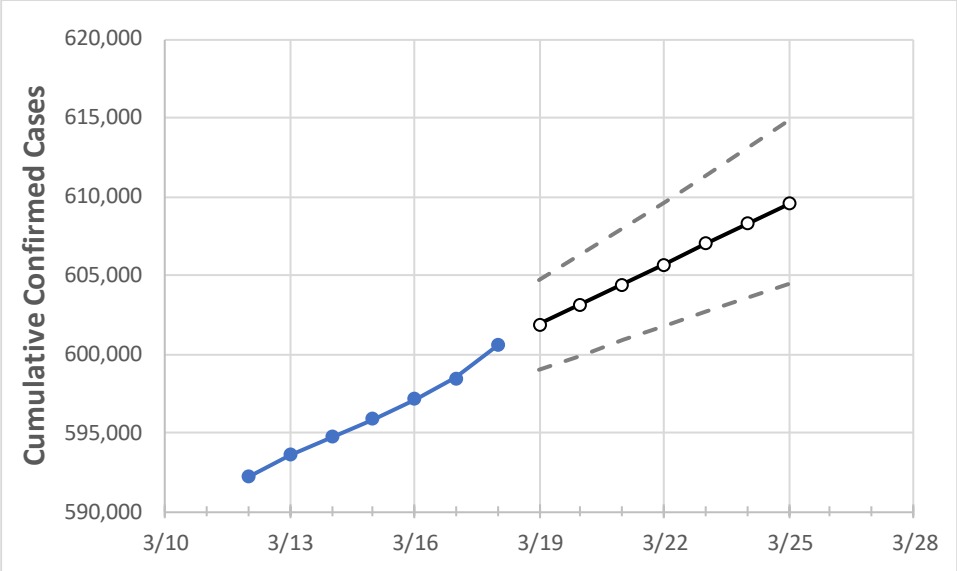
IEM's Modeling Lead

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Virginia	595,865	597,141	598,468	600,550	601,852	603,126	604,412	605,690	606,982	608,268	609,522

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Alexandria City	10,617	10,643	10,671	10,699	10,724	10,750	10,777	10,804	10,833	10,862	10,892
Arlington	13,683	13,729	13,770	13,811	13,839	13,867	13,894	13,921	13,947	13,974	13,999
Fairfax	69,771	69,918	70,194	70,393	70,535	70,681	70,826	70,972	71,118	71,262	71,406
Henrico	22,155	22,203	22,251	22,327	22,371	22,419	22,463	22,507	22,551	22,596	22,638
James City	4,028	4,039	4,051	4,061	4,073	4,085	4,096	4,108	4,119	4,131	4,143
Loudoun	24,060	24,197	24,345	24,434	24,533	24,633	24,741	24,848	24,958	25,072	25,189
Prince William	45,768	45,859	46,040	46,139	46,227	46,313	46,403	46,493	46,583	46,672	46,761
Virginia Beach City	31,848	31,937	32,001	32,116	32,199	32,283	32,366	32,446	32,528	32,613	32,693

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:		
	3/15	3/16	3/17	3/18	3/20	3/22	3/24
Alexandria City	10,617	10,643	10,671	10,699	10,750 (2,150) [516] {258}	10,804 (2,161) [519] {259}	10,862 (2,172) [521] {261}
Arlington	13,683	13,729	13,770	13,811	13,867 (2,773) [666] {333}	13,921 (2,784) [668] {334}	13,974 (2,795) [671] {335}
Fairfax	69,771	69,918	70,194	70,393	70,681 (14,136) [3,393] {1,696}	70,972 (14,194) [3,407] {1,703}	71,262 (14,252) [3,421] {1,710}
Henrico	22,155	22,203	22,251	22,327	22,419 (4,484) [1,076] {538}	22,507 (4,501) [1,080] {540}	22,596 (4,519) [1,085] {542}
James City	4,028	4,039	4,051	4,061	4,085 (817) [196] {98}	4,108 (822) [197] {99}	4,131 (826) [198] {99}
Loudoun	24,060	24,197	24,345	24,434	24,633 (4,927) [1,182] {591}	24,848 (4,970) [1,193] {596}	25,072 (5,014) [1,203] {602}
Prince William	45,768	45,859	46,040	46,139	46,313 (9,263) [2,223] {1,112}	46,493 (9,299) [2,232] {1,116}	46,672 (9,334) [2,240] {1,120}
Virginia Beach City	31,848	31,937	32,001	32,116	32,283 (6,457) [1,550] {775}	32,446 (6,489) [1,557] {779}	32,613 (6,523) [1,565] {783}

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.