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

Date: 3/24/21

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 3/24/21 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.

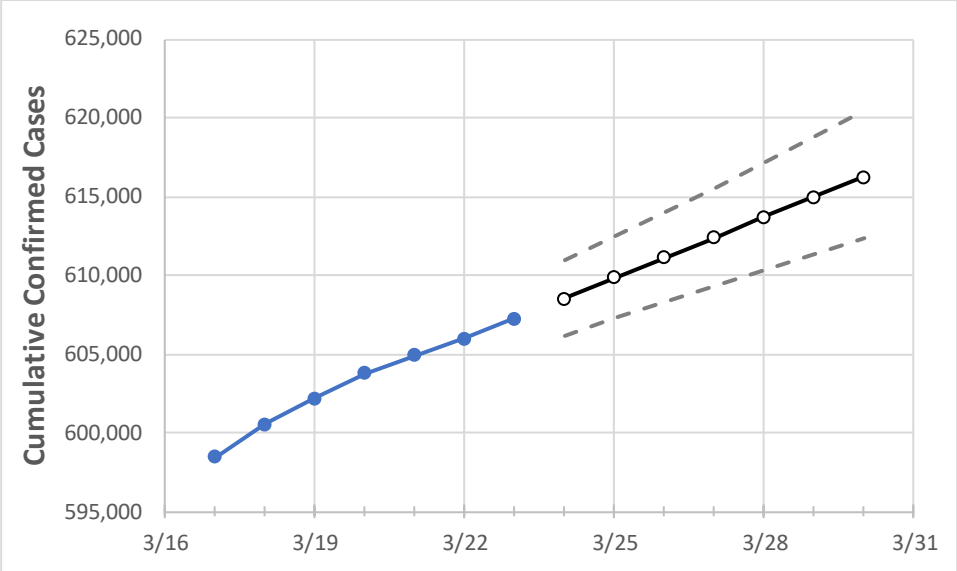
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Virginia	603,745	604,904	605,967	607,234	608,530	609,831	611,116	612,416	613,705	614,997	616,262

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Alexandria City	10,758	10,771	10,784	10,805	10,828	10,852	10,875	10,899	10,924	10,948	10,972
Arlington	13,882	13,897	13,915	13,952	13,980	14,009	14,037	14,065	14,092	14,120	14,146
Fairfax	70,741	70,860	70,983	71,122	71,272	71,421	71,569	71,719	71,867	72,013	72,159
Henrico	22,452	22,506	22,547	22,604	22,656	22,706	22,757	22,808	22,857	22,907	22,955
James City	4,085	4,113	4,124	4,127	4,139	4,152	4,164	4,176	4,188	4,200	4,213
Loudoun	24,552	24,603	24,659	24,706	24,785	24,866	24,945	25,027	25,106	25,188	25,271
Prince William	46,285	46,330	46,426	46,513	46,596	46,678	46,759	46,839	46,922	47,004	47,084
Virginia Beach City	32,303	32,361	32,465	32,516	32,596	32,672	32,751	32,829	32,904	32,978	33,050

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Alexandria City	10,758	10,771	10,784	10,805	10,852 (2,170) [521] {260}	10,899 (2,180) [523] {262}	10,948 (2,190) [526] {263}
Arlington	13,882	13,897	13,915	13,952	14,009 (2,802) [672] {336}	14,065 (2,813) [675] {338}	14,120 (2,824) [678] {339}
Fairfax	70,741	70,860	70,983	71,122	71,421 (14,284) [3,428] {1,714}	71,719 (14,344) [3,443] {1,721}	72,013 (14,403) [3,457] {1,728}
Henrico	22,452	22,506	22,547	22,604	22,706 (4,541) [1,090] {545}	22,808 (4,562) [1,095] {547}	22,907 (4,581) [1,100] {550}
James City	4,085	4,113	4,124	4,127	4,152 (830) [199] {100}	4,176 (835) [200] {100}	4,200 (840) [202] {101}
Loudoun	24,552	24,603	24,659	24,706	24,866 (4,973) [1,194] {597}	25,027 (5,005) [1,201] {601}	25,188 (5,038) [1,209] {605}
Prince William	46,285	46,330	46,426	46,513	46,678 (9,336) [2,241] {1,120}	46,839 (9,368) [2,248] {1,124}	47,004 (9,401) [2,256] {1,128}
Virginia Beach City	32,303	32,361	32,465	32,516	32,672 (6,534) [1,568] {784}	32,829 (6,566) [1,576] {788}	32,978 (6,596) [1,583] {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.