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

Date: 8/23/21

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 8/23/21 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.

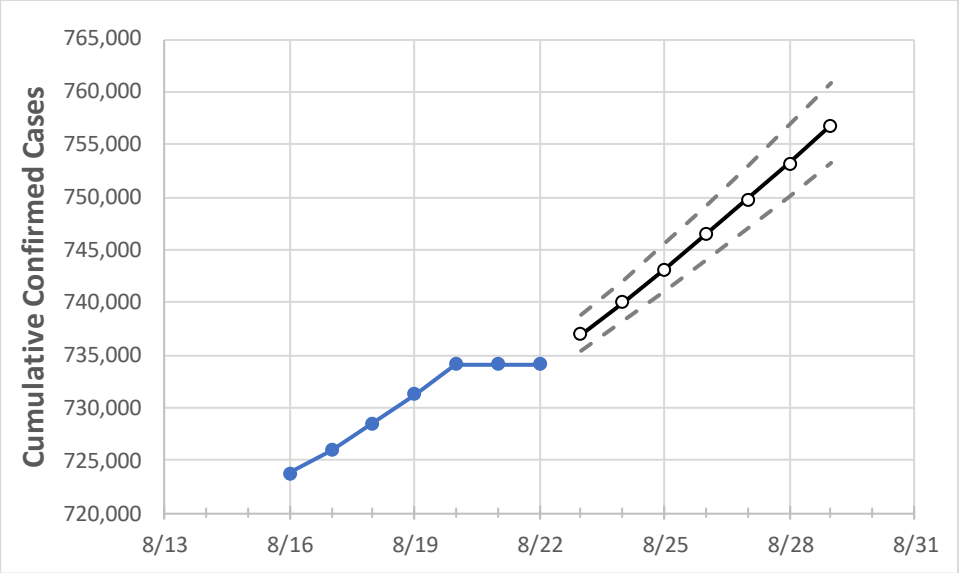
IEM's Modeling Lead

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:						
	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29
Virginia	731,287	734,079	734,079	734,079	737,001	740,046	743,168	746,424	749,756	753,225	756,802

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:						
	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29
Alexandria City	12,558	12,579	12,599	12,620	12,646	12,673	12,699	12,727	12,754	12,783	12,812
Arlington	16,236	16,266	16,297	16,327	16,362	16,398	16,433	16,470	16,507	16,544	16,582
Fairfax	82,146	82,297	82,449	82,600	82,781	82,967	83,154	83,346	83,544	83,746	83,953
Henrico	28,041	28,138	28,138	28,138	28,250	28,366	28,485	28,607	28,734	28,864	28,996
James City	5,195	5,225	5,225	5,225	5,264	5,304	5,347	5,392	5,439	5,489	5,540
Loudoun	29,644	29,707	29,770	29,833	29,897	29,963	30,029	30,097	30,167	30,239	30,309
Prince William	53,765	53,838	53,910	53,983	54,086	54,191	54,298	54,409	54,518	54,633	54,748
Virginia Beach City	40,020	40,203	40,203	40,203	40,430	40,667	40,908	41,165	41,427	41,700	41,987

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:		
	8/19	8/20	8/21	8/22	8/24	8/26	8/28
Alexandria City	12,558	12,579	12,599	12,620	12,673 (2,535) [608] {304}	12,727 (2,545) [611] {305}	12,783 (2,557) [614] {307}
Arlington	16,236	16,266	16,297	16,327	16,398 (3,280) [787] {394}	16,470 (3,294) [791] {395}	16,544 (3,309) [794] {397}
Fairfax	82,146	82,297	82,449	82,600	82,967 (16,593) [3,982] {1,991}	83,346 (16,669) [4,001] {2,000}	83,746 (16,749) [4,020] {2,010}
Henrico	28,041	28,138	28,138	28,138	28,366 (5,673) [1,362] {681}	28,607 (5,721) [1,373] {687}	28,864 (5,773) [1,385] {693}
James City	5,195	5,225	5,225	5,225	5,304 (1,061) [255] {127}	5,392 (1,078) [259] {129}	5,489 (1,098) [263] {132}
Loudoun	29,644	29,707	29,770	29,833	29,963 (5,993) [1,438] {719}	30,097 (6,019) [1,445] {722}	30,239 (6,048) [1,451] {726}
Prince William	53,765	53,838	53,910	53,983	54,191 (10,838) [2,601] {1,301}	54,409 (10,882) [2,612] {1,306}	54,633 (10,927) [2,622] {1,311}
Virginia Beach City	40,020	40,203	40,203	40,203	40,667 (8,133) [1,952] {976}	41,165 (8,233) [1,976] {988}	41,700 (8,340) [2,002] {1,001}

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.