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

Date: 12/1/21

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 12/1/21 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.

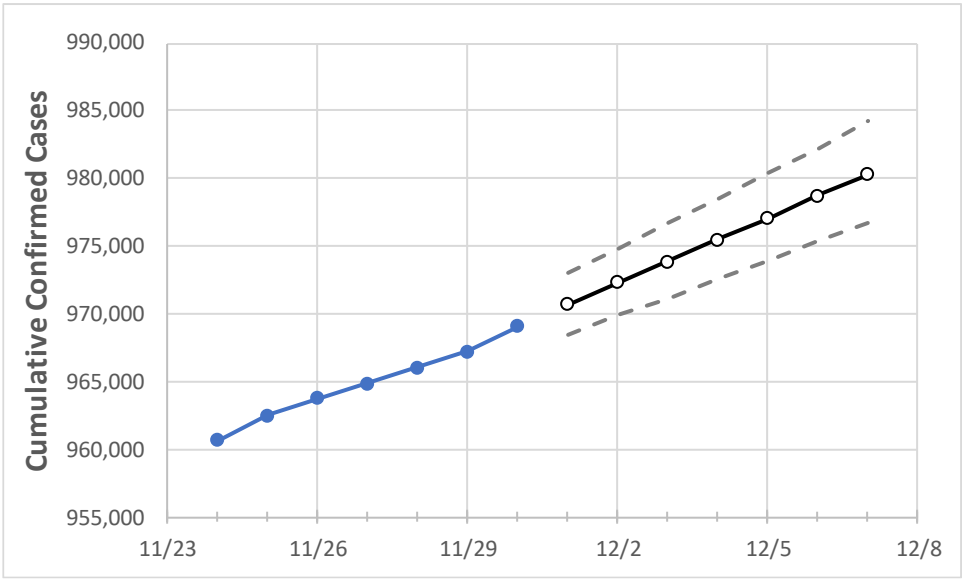
IEM's Modeling Lead

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Virginia	964,896	966,052	967,209	969,116	970,694	972,294	973,862	975,481	977,089	978,731	980,336

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Alexandria City	14,777	14,789	14,806	14,837	14,854	14,871	14,887	14,904	14,922	14,938	14,955
Arlington	19,451	19,470	19,505	19,543	19,572	19,602	19,631	19,661	19,691	19,721	19,750
Fairfax	96,556	96,651	96,799	97,058	97,220	97,388	97,555	97,722	97,896	98,075	98,255
Henrico	35,724	35,784	35,843	35,911	35,979	36,048	36,117	36,190	36,263	36,337	36,413
James City	7,382	7,396	7,409	7,421	7,436	7,451	7,466	7,481	7,496	7,512	7,527
Loudoun	35,798	35,847	35,934	36,064	36,144	36,223	36,304	36,387	36,474	36,561	36,647
Prince William	63,531	63,579	63,668	63,830	63,906	63,987	64,067	64,148	64,230	64,315	64,396
Virginia Beach City	51,274	51,331	51,389	51,469	51,532	51,596	51,659	51,724	51,790	51,857	51,922

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:		
	11/27	11/28	11/29	11/30	12/2	12/4	12/6
Alexandria City	14,777	14,789	14,806	14,837	14,871 (2,974) [714] {357}	14,904 (2,981) [715] {358}	14,938 (2,988) [717] {359}
Arlington	19,451	19,470	19,505	19,543	19,602 (3,920) [941] {470}	19,661 (3,932) [944] {472}	19,721 (3,944) [947] {473}
Fairfax	96,556	96,651	96,799	97,058	97,388 (19,478) [4,675] {2,337}	97,722 (19,544) [4,691] {2,345}	98,075 (19,615) [4,708] {2,354}
Henrico	35,724	35,784	35,843	35,911	36,048 (7,210) [1,730] {865}	36,190 (7,238) [1,737] {869}	36,337 (7,267) [1,744] {872}
James City	7,382	7,396	7,409	7,421	7,451 (1,490) [358] {179}	7,481 (1,496) [359] {180}	7,512 (1,502) [361] {180}
Loudoun	35,798	35,847	35,934	36,064	36,223 (7,245) [1,739] {869}	36,387 (7,277) [1,747] {873}	36,561 (7,312) [1,755] {877}
Prince William	63,531	63,579	63,668	63,830	63,987 (12,797) [3,071] {1,536}	64,148 (12,830) [3,079] {1,540}	64,315 (12,863) [3,087] {1,544}
Virginia Beach City	51,274	51,331	51,389	51,469	51,596 (10,319) [2,477] {1,238}	51,724 (10,345) [2,483] {1,241}	51,857 (10,371) [2,489] {1,245}

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.