IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/1/21

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 <u>not</u> 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 10/1/21 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
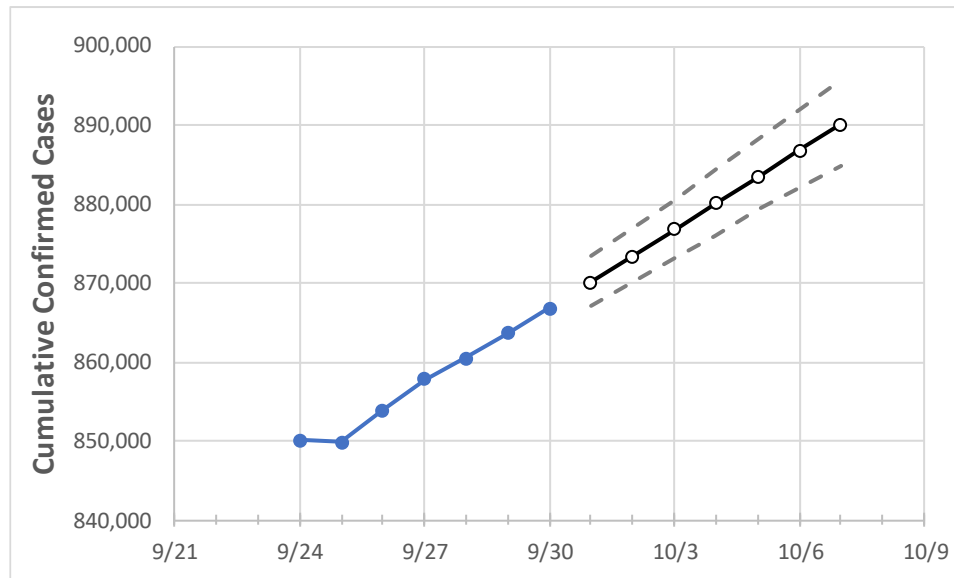
	Actual Confirmed Cases On:				Projected Cases For:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
Virginia	857,852	860,493	863,644	866,776	870,097	873,429	876,753	880,065	883,400	886,796	890,101

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:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
Alexandria City	13,605	13,625	13,650	13,674	13,697	13,720	13,743	13,765	13,788	13,810	13,833
Arlington	17,709	17,750	17,775	17,799	17,830	17,861	17,891	17,921	17,952	17,982	18,012
Fairfax	89,091	89,326	89,479	89,617	89,794	89,967	90,141	90,314	90,489	90,667	90,839
Henrico	32,324	32,411	32,493	32,584	32,673	32,757	32,843	32,928	33,012	33,096	33,180
James City	6,382	6,413	6,450	6,489	6,518	6,546	6,575	6,603	6,632	6,661	6,688
Loudoun	32,604	32,662	32,745	32,793	32,874	32,955	33,034	33,115	33,197	33,279	33,360
Prince William	58,331	58,537	58,690	58,821	58,966	59,106	59,250	59,396	59,544	59,692	59,845
Virginia Beach City	47,036	47,177	47,260	47,397	47,523	47,644	47,766	47,885	48,006	48,124	48,242

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:		
	9/27	9/28	9/29	9/30	10/2	10/4	10/6
Alexandria City	13,605	13,625	13,650	13,674	13,720 (2,744) [659] {329}	13,765 (2,753) [661] {330}	13,810 (2,762) [663] {331}
Arlington	17,709	17,750	17,775	17,799	17,861 (3,572) [857] {429}	17,921 (3,584) [860] {430}	17,982 (3,596) [863] {432}
Fairfax	89,091	89,326	89,479	89,617	89,967 (17,993) [4,318] {2,159}	90,314 (18,063) [4,335] {2,168}	90,667 (18,133) [4,352] {2,176}
Henrico	32,324	32,411	32,493	32,584	32,757 (6,551) [1,572] {786}	32,928 (6,586) [1,581] {790}	33,096 (6,619) [1,589] {794}
James City	6,382	6,413	6,450	6,489	6,546 (1,309) [314] {157}	6,603 (1,321) [317] {158}	6,661 (1,332) [320] {160}
Loudoun	32,604	32,662	32,745	32,793	32,955 (6,591) [1,582] {791}	33,115 (6,623) [1,590] {795}	33,279 (6,656) [1,597] {799}
Prince William	58,331	58,537	58,690	58,821	59,106 (11,821) [2,837] {1,419}	59,396 (11,879) [2,851] {1,426}	59,692 (11,938) [2,865] {1,433}
Virginia Beach City	47,036	47,177	47,260	47,397	47,644 (9,529) [2,287] {1,143}	47,885 (9,577) [2,299] {1,149}	48,124 (9,625) [2,310] {1,155}

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.