IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/6/21

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 10/6/21 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
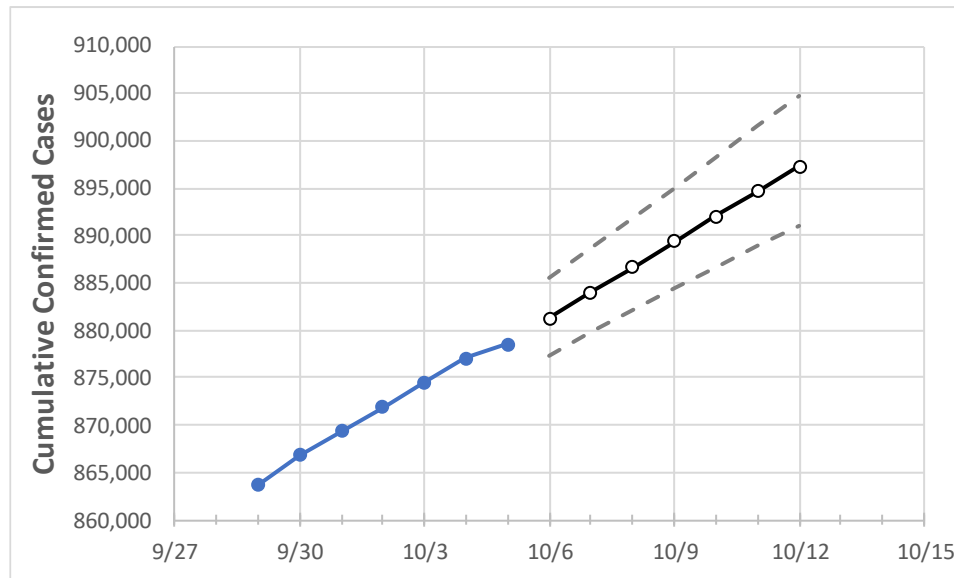
	Actual Confirmed Cases On:				Projected Cases For:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Virginia	871,915	874,503	877,090	878,518	881,298	884,064	886,704	889,399	892,058	894,721	897,362

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Alexandria City	13,727	13,754	13,761	13,761	13,782	13,803	13,823	13,843	13,864	13,884	13,904
Arlington	17,870	17,906	17,926	17,926	17,956	17,987	18,018	18,048	18,077	18,109	18,139
Fairfax	89,879	90,010	90,055	90,055	90,187	90,320	90,452	90,577	90,709	90,833	90,952
Henrico	32,739	32,818	32,898	32,944	33,017	33,086	33,154	33,223	33,290	33,358	33,422
James City	6,550	6,581	6,611	6,615	6,644	6,673	6,703	6,732	6,762	6,793	6,823
Loudoun	32,900	32,954	33,017	33,017	33,073	33,129	33,182	33,236	33,288	33,342	33,393
Prince William	59,022	59,123	59,181	59,181	59,294	59,407	59,520	59,628	59,741	59,850	59,958
Virginia Beach City	47,616	47,743	47,869	47,928	48,031	48,131	48,229	48,325	48,419	48,515	48,605

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:		
	10/2	10/3	10/4	10/5	10/7	10/9	10/11
Alexandria City	13,727	13,754	13,761	13,761	13,803 (2,761) [663] {331}	13,843 (2,769) [664] {332}	13,884 (2,777) [666] {333}
Arlington	17,870	17,906	17,926	17,926	17,987 (3,597) [863] {432}	18,048 (3,610) [866] {433}	18,109 (3,622) [869] {435}
Fairfax	89,879	90,010	90,055	90,055	90,320 (18,064) [4,335] {2,168}	90,577 (18,115) [4,348] {2,174}	90,833 (18,167) [4,360] {2,180}
Henrico	32,739	32,818	32,898	32,944	33,086 (6,617) [1,588] {794}	33,223 (6,645) [1,595] {797}	33,358 (6,672) [1,601] {801}
James City	6,550	6,581	6,611	6,615	6,673 (1,335) [320] {160}	6,732 (1,346) [323] {162}	6,793 (1,359) [326] {163}
Loudoun	32,900	32,954	33,017	33,017	33,129 (6,626) [1,590] {795}	33,236 (6,647) [1,595] {798}	33,342 (6,668) [1,600] {800}
Prince William	59,022	59,123	59,181	59,181	59,407 (11,881) [2,852] {1,426}	59,628 (11,926) [2,862] {1,431}	59,850 (11,970) [2,873] {1,436}
Virginia Beach City	47,616	47,743	47,869	47,928	48,131 (9,626) [2,310] {1,155}	48,325 (9,665) [2,320] {1,160}	48,515 (9,703) [2,329] {1,164}

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.