IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/10/21

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 5/10/21 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
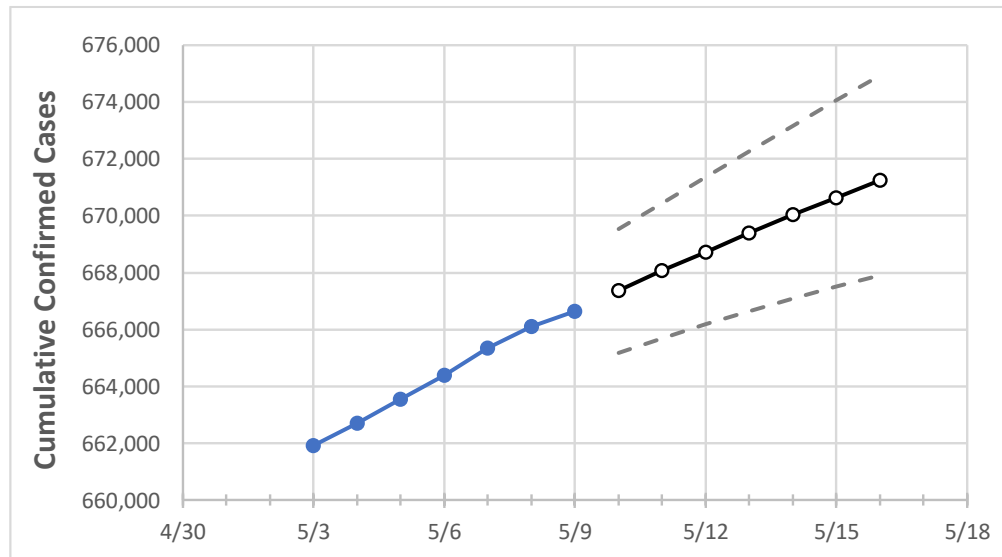
	Actual Confirmed Cases On:				Projected Cases For:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
Virginia	664,394	665,332	666,111	666,650	667,358	668,058	668,728	669,381	670,024	670,639	671,241

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:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
Alexandria City	11,726	11,735	11,752	11,754	11,763	11,772	11,781	11,789	11,797	11,806	11,813
Arlington	15,198	15,214	15,226	15,231	15,243	15,255	15,266	15,277	15,288	15,297	15,307
Fairfax	77,298	77,358	77,400	77,422	77,476	77,526	77,578	77,625	77,673	77,717	77,759
Henrico	25,151	25,163	25,191	25,219	25,243	25,265	25,287	25,308	25,328	25,347	25,366
James City	4,575	4,580	4,583	4,586	4,590	4,595	4,599	4,603	4,607	4,611	4,614
Loudoun	27,589	27,614	27,635	27,655	27,685	27,714	27,744	27,772	27,799	27,826	27,851
Prince William	50,455	50,501	50,549	50,561	50,602	50,639	50,676	50,711	50,746	50,780	50,812
Virginia Beach City	35,637	35,673	35,709	35,735	35,770	35,804	35,837	35,868	35,898	35,927	35,955

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:		
	5/6	5/7	5/8	5/9	5/11	5/13	5/15
Alexandria City	11,726	11,735	11,752	11,754	11,772 (2,354) [565] {283}	11,789 (2,358) [566] {283}	11,806 (2,361) [567] {283}
Arlington	15,198	15,214	15,226	15,231	15,255 (3,051) [732] {366}	15,277 (3,055) [733] {367}	15,297 (3,059) [734] {367}
Fairfax	77,298	77,358	77,400	77,422	77,526 (15,505) [3,721] {1,861}	77,625 (15,525) [3,726] {1,863}	77,717 (15,543) [3,730] {1,865}
Henrico	25,151	25,163	25,191	25,219	25,265 (5,053) [1,213] {606}	25,308 (5,062) [1,215] {607}	25,347 (5,069) [1,217] {608}
James City	4,575	4,580	4,583	4,586	4,595 (919) [221] {110}	4,603 (921) [221] {110}	4,611 (922) [221] {111}
Loudoun	27,589	27,614	27,635	27,655	27,714 (5,543) [1,330] {665}	27,772 (5,554) [1,333] {667}	27,826 (5,565) [1,336] {668}
Prince William	50,455	50,501	50,549	50,561	50,639 (10,128) [2,431] {1,215}	50,711 (10,142) [2,434] {1,217}	50,780 (10,156) [2,437] {1,219}
Virginia Beach City	35,637	35,673	35,709	35,735	35,804 (7,161) [1,719] {859}	35,868 (7,174) [1,722] {861}	35,927 (7,185) [1,725] {862}

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.