IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/9/21

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 6/9/21 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
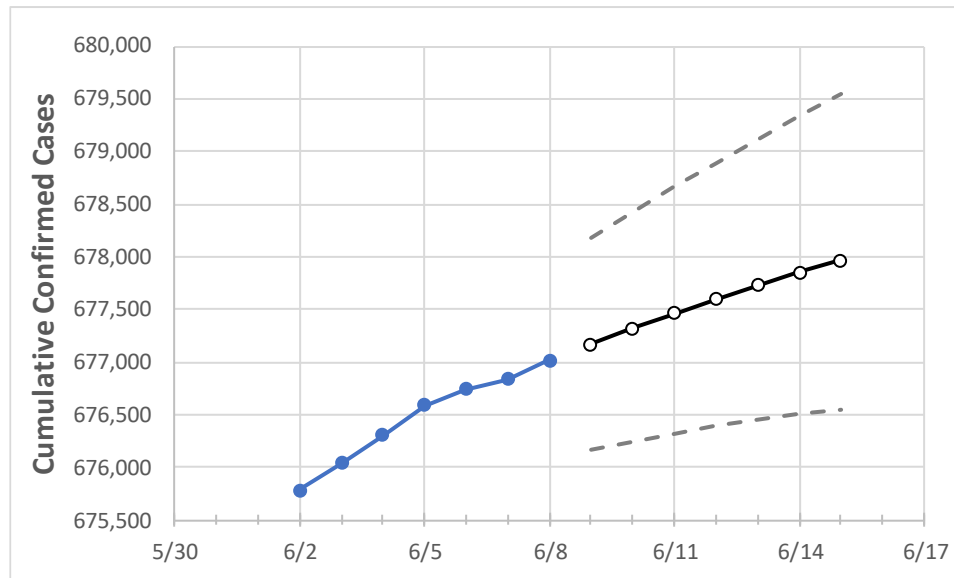
	Actual Confirmed Cases On:				**Projected Cases For:**						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Virginia	676,586	676,741	676,831	677,013	677,169	677,321	677,458	677,596	677,724	677,852	677,968

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:**						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Alexandria City	11,846	11,847	11,847	11,848	11,849	11,851	11,852	11,853	11,854	11,856	11,857
Arlington	15,295	15,296	15,295	15,290	15,291	15,293	15,294	15,295	15,296	15,297	15,298
Fairfax	78,027	78,034	78,025	78,018	78,025	78,032	78,038	78,044	78,049	78,054	78,059
Henrico	25,569	25,578	25,580	25,580	25,585	25,590	25,594	25,598	25,602	25,606	25,610
James City	4,646	4,648	4,649	4,649	4,651	4,652	4,654	4,655	4,657	4,658	4,660
Loudoun	27,969	27,975	27,986	27,991	27,997	28,003	28,008	28,013	28,018	28,023	28,028
Prince William	51,008	51,022	51,039	51,059	51,068	51,077	51,086	51,094	51,102	51,110	51,118
Virginia Beach City	36,237	36,239	36,243	36,255	36,264	36,272	36,279	36,287	36,294	36,301	36,307

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:		
	6/5	6/6	6/7	6/8	6/10	6/12	6/14
Alexandria City	11,846	11,847	11,847	11,848	11,851 (2,370) [569] {284}	11,853 (2,371) [569] {284}	11,856 (2,371) [569] {285}
Arlington	15,295	15,296	15,295	15,290	15,293 (3,059) [734] {367}	15,295 (3,059) [734] {367}	15,297 (3,059) [734] {367}
Fairfax	78,027	78,034	78,025	78,018	78,032 (15,606) [3,746] {1,873}	78,044 (15,609) [3,746] {1,873}	78,054 (15,611) [3,747] {1,873}
Henrico	25,569	25,578	25,580	25,580	25,590 (5,118) [1,228] {614}	25,598 (5,120) [1,229] {614}	25,606 (5,121) [1,229] {615}
James City	4,646	4,648	4,649	4,649	4,652 (930) [223] {112}	4,655 (931) [223] {112}	4,658 (932) [224] {112}
Loudoun	27,969	27,975	27,986	27,991	28,003 (5,601) [1,344] {672}	28,013 (5,603) [1,345] {672}	28,023 (5,605) [1,345] {673}
Prince William	51,008	51,022	51,039	51,059	51,077 (10,215) [2,452] {1,226}	51,094 (10,219) [2,453] {1,226}	51,110 (10,222) [2,453] {1,227}
Virginia Beach City	36,237	36,239	36,243	36,255	36,272 (7,254) [1,741] {871}	36,287 (7,257) [1,742] {871}	36,301 (7,260) [1,742] {871}

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.