IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/2/21

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 4/2/21 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
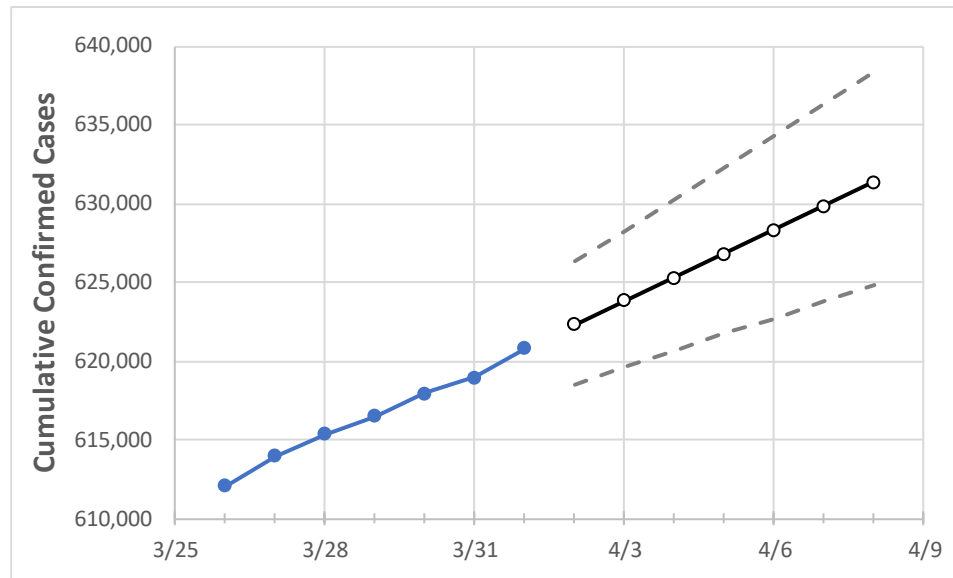
	Actual Confirmed Cases On:			Projected Cases For:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Virginia	616,509	617,941	618,976	620,801	622,310	623,818	625,319	626,833	628,337	629,873	631,389

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Alexandria City	10,924	10,940	10,965	10,996	11,017	11,038	11,058	11,079	11,100	11,120	11,140
Arlington	14,188	14,227	14,273	14,319	14,359	14,401	14,443	14,484	14,527	14,571	14,616
Fairfax	72,224	72,319	72,572	72,721	72,894	73,068	73,244	73,416	73,597	73,778	73,959
Henrico	23,073	23,146	23,156	23,244	23,317	23,390	23,465	23,541	23,615	23,691	23,770
James City	4,250	4,252	4,254	4,279	4,295	4,310	4,326	4,343	4,359	4,376	4,392
Loudoun	25,221	25,251	25,391	25,452	25,524	25,600	25,674	25,750	25,829	25,909	25,986
Prince William	47,198	47,262	47,431	47,530	47,644	47,759	47,877	47,993	48,113	48,234	48,363
Virginia Beach City	33,029	33,122	33,166	33,253	33,331	33,409	33,487	33,565	33,640	33,716	33,793

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Alexandria City	10,924	10,940	10,965	10,996	11,038 (2,208) [530] {265}	11,079 (2,216) [532] {266}	11,120 (2,224) [534] {267}
Arlington	14,188	14,227	14,273	14,319	14,401 (2,880) [691] {346}	14,484 (2,897) [695] {348}	14,571 (2,914) [699] {350}
Fairfax	72,224	72,319	72,572	72,721	73,068 (14,614) [3,507] {1,754}	73,416 (14,683) [3,524] {1,762}	73,778 (14,756) [3,541] {1,771}
Henrico	23,073	23,146	23,156	23,244	23,390 (4,678) [1,123] {561}	23,541 (4,708) [1,130] {565}	23,691 (4,738) [1,137] {569}
James City	4,250	4,252	4,254	4,279	4,310 (862) [207] {103}	4,343 (869) [208] {104}	4,376 (875) [210] {105}
Loudoun	25,221	25,251	25,391	25,452	25,600 (5,120) [1,229] {614}	25,750 (5,150) [1,236] {618}	25,909 (5,182) [1,244] {622}
Prince William	47,198	47,262	47,431	47,530	47,759 (9,552) [2,292] {1,146}	47,993 (9,599) [2,304] {1,152}	48,234 (9,647) [2,315] {1,158}
Virginia Beach City	33,029	33,122	33,166	33,253	33,409 (6,682) [1,604] {802}	33,565 (6,713) [1,611] {806}	33,716 (6,743) [1,618] {809}

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.