IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/2/21

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 3/2/21 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
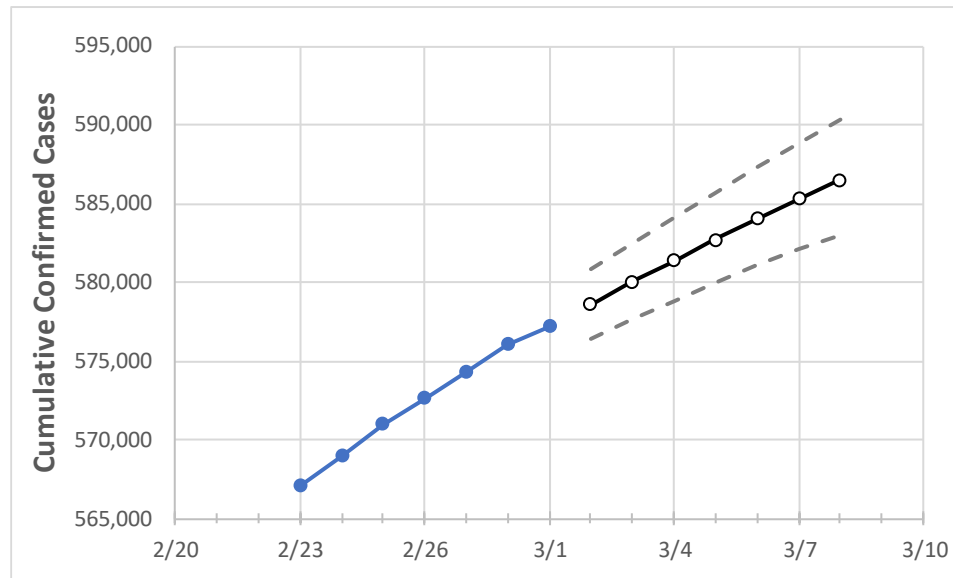
	Actual Confirmed Cases On:				Projected Cases For:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Virginia	572,639	574,314	576,050	577,174	578,616	580,029	581,398	582,721	584,021	585,281	586,493

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Alexandria City	10,299	10,328	10,342	10,352	10,370	10,386	10,403	10,418	10,433	10,448	10,462
Arlington	13,112	13,151	13,182	13,215	13,250	13,285	13,319	13,351	13,383	13,414	13,445
Fairfax	67,194	67,415	67,547	67,670	67,829	67,983	68,134	68,280	68,423	68,560	68,696
Henrico	21,234	21,330	21,387	21,446	21,502	21,556	21,609	21,657	21,707	21,755	21,802
James City	3,835	3,846	3,867	3,880	3,889	3,899	3,907	3,916	3,925	3,933	3,941
Loudoun	22,997	23,076	23,126	23,183	23,234	23,285	23,333	23,379	23,426	23,471	23,515
Prince William	44,328	44,459	44,529	44,608	44,688	44,765	44,840	44,912	44,982	45,049	45,115
Virginia Beach City	30,393	30,491	30,595	30,652	30,738	30,820	30,898	30,974	31,048	31,121	31,189

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Alexandria City	10,299	10,328	10,342	10,352	10,386 (2,077) [499] {249}	10,418 (2,084) [500] {250}	10,448 (2,090) [501] {251}
Arlington	13,112	13,151	13,182	13,215	13,285 (2,657) [638] {319}	13,351 (2,670) [641] {320}	13,414 (2,683) [644] {322}
Fairfax	67,194	67,415	67,547	67,670	67,983 (13,597) [3,263] {1,632}	68,280 (13,656) [3,277] {1,639}	68,560 (13,712) [3,291] {1,645}
Henrico	21,234	21,330	21,387	21,446	21,556 (4,311) [1,035] {517}	21,657 (4,331) [1,040] {520}	21,755 (4,351) [1,044] {522}
James City	3,835	3,846	3,867	3,880	3,899 (780) [187] {94}	3,916 (783) [188] {94}	3,933 (787) [189] {94}
Loudoun	22,997	23,076	23,126	23,183	23,285 (4,657) [1,118] {559}	23,379 (4,676) [1,122] {561}	23,471 (4,694) [1,127] {563}
Prince William	44,328	44,459	44,529	44,608	44,765 (8,953) [2,149] {1,074}	44,912 (8,982) [2,156] {1,078}	45,049 (9,010) [2,162] {1,081}
Virginia Beach City	30,393	30,491	30,595	30,652	30,820 (6,164) [1,479] {740}	30,974 (6,195) [1,487] {743}	31,121 (6,224) [1,494] {747}

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.