IEM's AI Modeling: Short-term COVID-19 Projections

Date: 4/15/21

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 4/15/21 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.

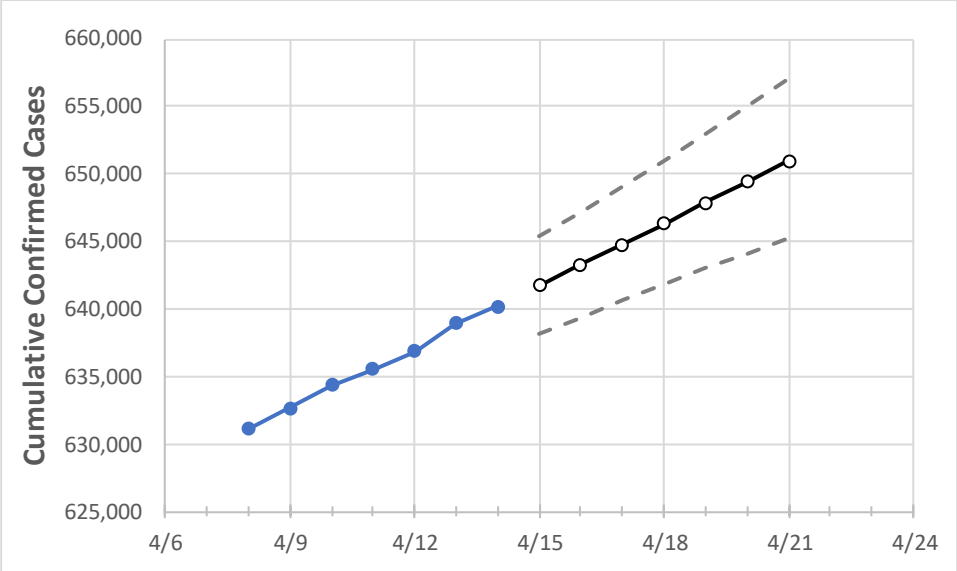
IEM's Modeling Lead

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Virginia	635,552	636,862	638,910	640,211	641,753	643,271	644,784	646,330	647,858	649,428	650,964

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Alexandria City	11,325	11,348	11,375	11,375	11,411	11,447	11,484	11,522	11,560	11,599	11,638
Arlington	14,679	14,697	14,718	14,718	14,749	14,779	14,809	14,839	14,869	14,900	14,929
Fairfax	74,455	74,689	74,784	74,784	74,946	75,114	75,282	75,452	75,623	75,794	75,973
Henrico	23,923	23,984	24,088	24,147	24,220	24,290	24,362	24,432	24,505	24,577	24,652
James City	4,373	4,393	4,404	4,414	4,425	4,436	4,447	4,457	4,467	4,478	4,489
Loudoun	26,243	26,379	26,430	26,430	26,514	26,599	26,686	26,776	26,865	26,955	27,045
Prince William	48,654	48,787	48,862	48,862	48,974	49,087	49,199	49,314	49,431	49,553	49,676
Virginia Beach City	34,010	34,068	34,174	34,245	34,318	34,392	34,464	34,537	34,607	34,679	34,749

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:		
	4/11	4/12	4/13	4/14	4/16	4/18	4/20
Alexandria City	11,325	11,348	11,375	11,375	11,447 (2,289) [549] {275}	11,522 (2,304) [553] {277}	11,599 (2,320) [557] {278}
Arlington	14,679	14,697	14,718	14,718	14,779 (2,956) [709] {355}	14,839 (2,968) [712] {356}	14,900 (2,980) [715] {358}
Fairfax	74,455	74,689	74,784	74,784	75,114 (15,023) [3,605] {1,803}	75,452 (15,090) [3,622] {1,811}	75,794 (15,159) [3,638] {1,819}
Henrico	23,923	23,984	24,088	24,147	24,290 (4,858) [1,166] {583}	24,432 (4,886) [1,173] {586}	24,577 (4,915) [1,180] {590}
James City	4,373	4,393	4,404	4,414	4,436 (887) [213] {106}	4,457 (891) [214] {107}	4,478 (896) [215] {107}
Loudoun	26,243	26,379	26,430	26,430	26,599 (5,320) [1,277] {638}	26,776 (5,355) [1,285] {643}	26,955 (5,391) [1,294] {647}
Prince William	48,654	48,787	48,862	48,862	49,087 (9,817) [2,356] {1,178}	49,314 (9,863) [2,367] {1,184}	49,553 (9,911) [2,379] {1,189}
Virginia Beach City	34,010	34,068	34,174	34,245	34,392 (6,878) [1,651] {825}	34,537 (6,907) [1,658] {829}	34,679 (6,936) [1,665] {832}

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.