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

Date: 1/20/21

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 1/20/21 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.

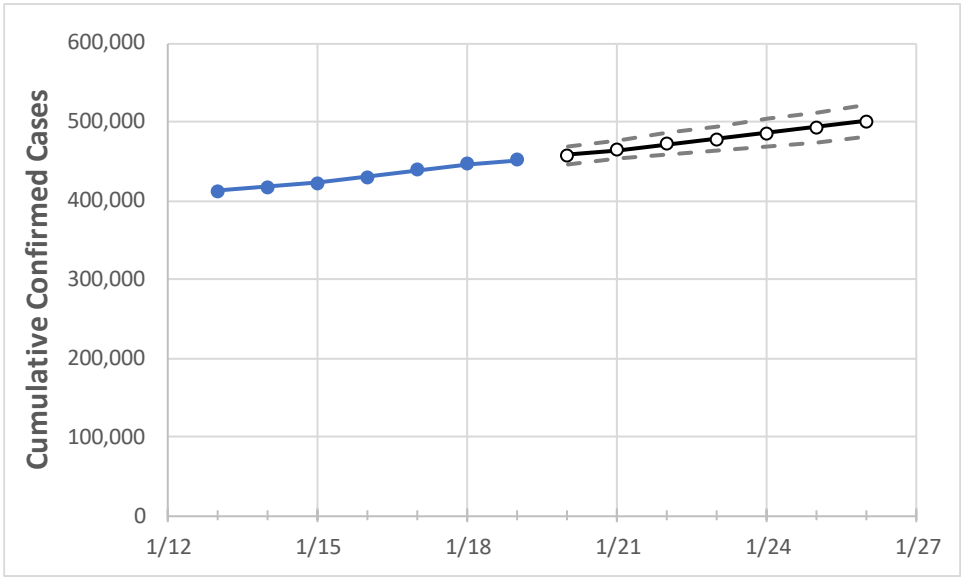
IEM's Modeling Lead

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Virginia	429,391	439,305	446,550	451,076	457,764	464,461	471,393	478,519	485,732	493,188	500,840

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Alexandria City	8,612	8,679	8,745	8,810	8,887	8,964	9,041	9,119	9,195	9,273	9,350
Arlington	10,677	10,734	10,790	10,860	10,953	11,047	11,144	11,239	11,333	11,426	11,522
Fairfax	54,587	54,906	55,225	55,534	56,154	56,791	57,433	58,088	58,750	59,418	60,121
Henrico	15,557	15,877	16,163	16,396	16,648	16,905	17,167	17,439	17,719	18,003	18,289
James City	2,580	2,685	2,772	2,825	2,893	2,965	3,040	3,119	3,202	3,286	3,378
Loudoun	16,637	16,826	17,014	17,236	17,461	17,698	17,942	18,196	18,461	18,734	19,014
Prince William	35,803	36,100	36,396	36,736	37,266	37,811	38,380	38,960	39,573	40,192	40,849
Virginia Beach City	22,013	22,393	22,857	23,074	23,455	23,832	24,220	24,604	24,998	25,400	25,806

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:		
	1/16	1/17	1/18	1/19	1/21	1/23	1/25
Alexandria City	8,612	8,679	8,745	8,810	8,964 (1,793) [430] {215}	9,119 (1,824) [438] {219}	9,273 (1,855) [445] {223}
Arlington	10,677	10,734	10,790	10,860	11,047 (2,209) [530] {265}	11,239 (2,248) [539] {270}	11,426 (2,285) [548] {274}
Fairfax	54,587	54,906	55,225	55,534	56,791 (11,358) [2,726] {1,363}	58,088 (11,618) [2,788] {1,394}	59,418 (11,884) [2,852] {1,426}
Henrico	15,557	15,877	16,163	16,396	16,905 (3,381) [811] {406}	17,439 (3,488) [837] {419}	18,003 (3,601) [864] {432}
James City	2,580	2,685	2,772	2,825	2,965 (593) [142] {71}	3,119 (624) [150] {75}	3,286 (657) [158] {79}
Loudoun	16,637	16,826	17,014	17,236	17,698 (3,540) [850] {425}	18,196 (3,639) [873] {437}	18,734 (3,747) [899] {450}
Prince William	35,803	36,100	36,396	36,736	37,811 (7,562) [1,815] {907}	38,960 (7,792) [1,870] {935}	40,192 (8,038) [1,929] {965}
Virginia Beach City	22,013	22,393	22,857	23,074	23,832 (4,766) [1,144] {572}	24,604 (4,921) [1,181] {591}	25,400 (5,080) [1,219] {610}

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.