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

Date: 1/19/21

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 1/19/21 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.

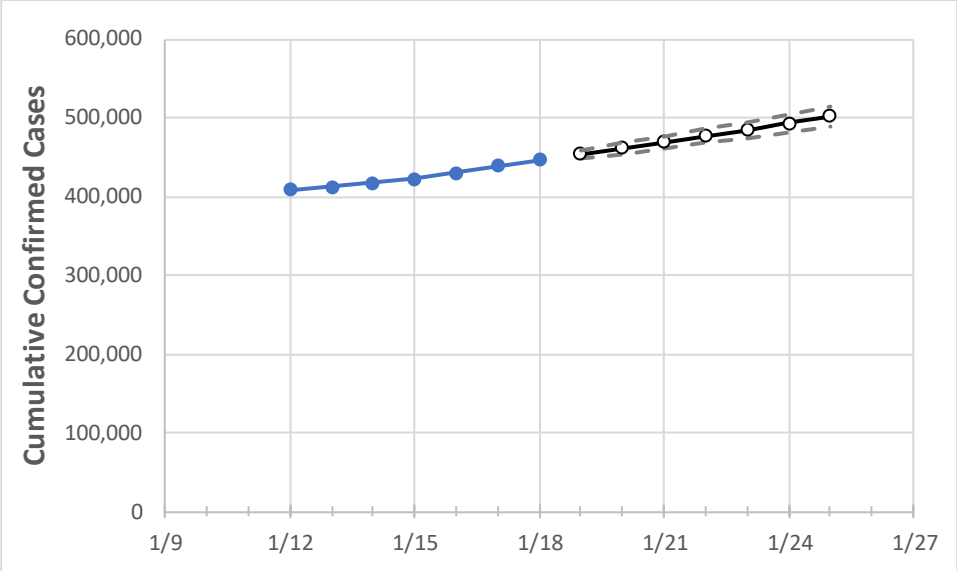
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Virginia	422,634	429,391	439,305	446,550	453,673	461,038	468,666	476,519	484,658	493,040	501,658

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Alexandria City	8,514	8,612	8,679	8,745	8,827	8,908	8,992	9,075	9,157	9,241	9,323
Arlington	10,520	10,677	10,734	10,790	10,883	10,977	11,071	11,162	11,262	11,363	11,457
Fairfax	53,064	54,587	54,906	55,225	55,921	56,640	57,369	58,119	58,883	59,670	60,473
Henrico	15,231	15,557	15,877	16,163	16,415	16,671	16,935	17,204	17,473	17,755	18,038
James City	2,515	2,580	2,685	2,772	2,846	2,928	3,009	3,097	3,189	3,286	3,390
Loudoun	16,245	16,637	16,826	17,014	17,240	17,471	17,715	17,970	18,238	18,517	18,806
Prince William	34,295	35,803	36,100	36,396	36,947	37,532	38,142	38,792	39,467	40,155	40,887
Virginia Beach City	21,680	22,013	22,393	22,857	23,251	23,646	24,056	24,464	24,878	25,299	25,731

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:		
	1/15	1/16	1/17	1/18	1/20	1/22	1/24
Alexandria City	8,514	8,612	8,679	8,745	8,908 (1,782) [428] {214}	9,075 (1,815) [436] {218}	9,241 (1,848) [444] {222}
Arlington	10,520	10,677	10,734	10,790	10,977 (2,195) [527] {263}	11,162 (2,232) [536] {268}	11,363 (2,273) [545] {273}
Fairfax	53,064	54,587	54,906	55,225	56,640 (11,328) [2,719] {1,359}	58,119 (11,624) [2,790] {1,395}	59,670 (11,934) [2,864] {1,432}
Henrico	15,231	15,557	15,877	16,163	16,671 (3,334) [800] {400}	17,204 (3,441) [826] {413}	17,755 (3,551) [852] {426}
James City	2,515	2,580	2,685	2,772	2,928 (586) [141] {70}	3,097 (619) [149] {74}	3,286 (657) [158] {79}
Loudoun	16,245	16,637	16,826	17,014	17,471 (3,494) [839] {419}	17,970 (3,594) [863] {431}	18,517 (3,703) [889] {444}
Prince William	34,295	35,803	36,100	36,396	37,532 (7,506) [1,802] {901}	38,792 (7,758) [1,862] {931}	40,155 (8,031) [1,927] {964}
Virginia Beach City	21,680	22,013	22,393	22,857	23,646 (4,729) [1,135] {568}	24,464 (4,893) [1,174] {587}	25,299 (5,060) [1,214] {607}

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.