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

Date: 2/23/21

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 2/23/21 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.

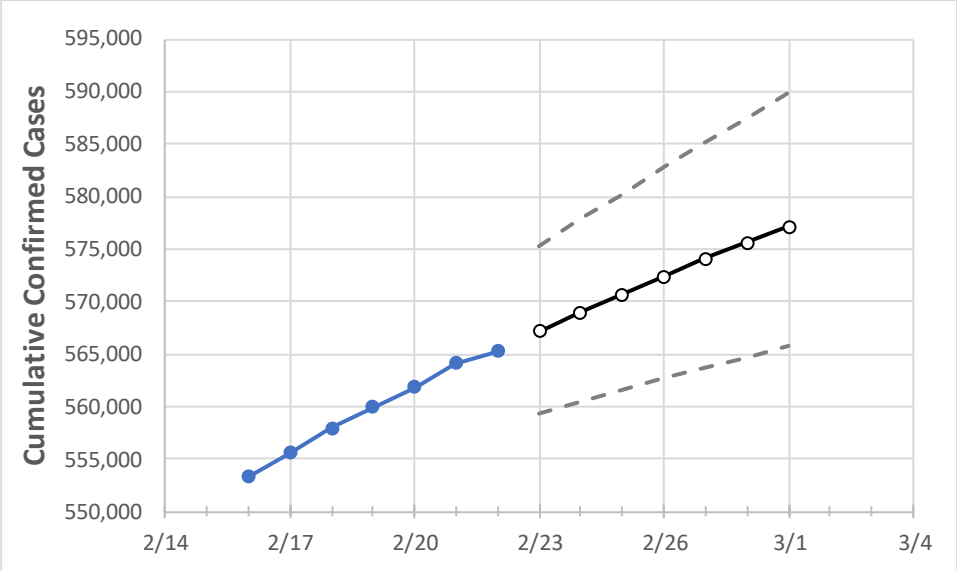
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Virginia	559,930	561,812	564,115	565,270	567,117	568,924	570,704	572,397	574,096	575,625	577,156

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Alexandria City	10,134	10,171	10,186	10,210	10,234	10,257	10,279	10,302	10,323	10,343	10,363
Arlington	12,805	12,870	12,894	12,922	12,955	12,988	13,020	13,050	13,080	13,107	13,134
Fairfax	65,738	66,025	66,137	66,290	66,482	66,665	66,843	67,014	67,181	67,342	67,497
Henrico	20,736	20,810	20,895	20,950	21,021	21,088	21,156	21,221	21,281	21,338	21,395
James City	3,750	3,774	3,792	3,806	3,815	3,823	3,831	3,838	3,845	3,852	3,859
Loudoun	22,557	22,654	22,704	22,762	22,813	22,859	22,905	22,947	22,987	23,026	23,065
Prince William	43,572	43,746	43,819	43,919	44,021	44,116	44,207	44,294	44,375	44,453	44,530
Virginia Beach City	29,552	29,660	29,786	29,876	29,984	30,090	30,189	30,286	30,381	30,472	30,559

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Alexandria City	10,134	10,171	10,186	10,210	10,257 (2,051) [492] {246}	10,302 (2,060) [494] {247}	10,343 (2,069) [496] {248}
Arlington	12,805	12,870	12,894	12,922	12,988 (2,598) [623] {312}	13,050 (2,610) [626] {313}	13,107 (2,621) [629] {315}
Fairfax	65,738	66,025	66,137	66,290	66,665 (13,333) [3,200] {1,600}	67,014 (13,403) [3,217] {1,608}	67,342 (13,468) [3,232] {1,616}
Henrico	20,736	20,810	20,895	20,950	21,088 (4,218) [1,012] {506}	21,221 (4,244) [1,019] {509}	21,338 (4,268) [1,024] {512}
James City	3,750	3,774	3,792	3,806	3,823 (765) [184] {92}	3,838 (768) [184] {92}	3,852 (770) [185] {92}
Loudoun	22,557	22,654	22,704	22,762	22,859 (4,572) [1,097] {549}	22,947 (4,589) [1,101] {551}	23,026 (4,605) [1,105] {553}
Prince William	43,572	43,746	43,819	43,919	44,116 (8,823) [2,118] {1,059}	44,294 (8,859) [2,126] {1,063}	44,453 (8,891) [2,134] {1,067}
Virginia Beach City	29,552	29,660	29,786	29,876	30,090 (6,018) [1,444] {722}	30,286 (6,057) [1,454] {727}	30,472 (6,094) [1,463] {731}

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.