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

Date: 3/3/21

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 3/3/21 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.

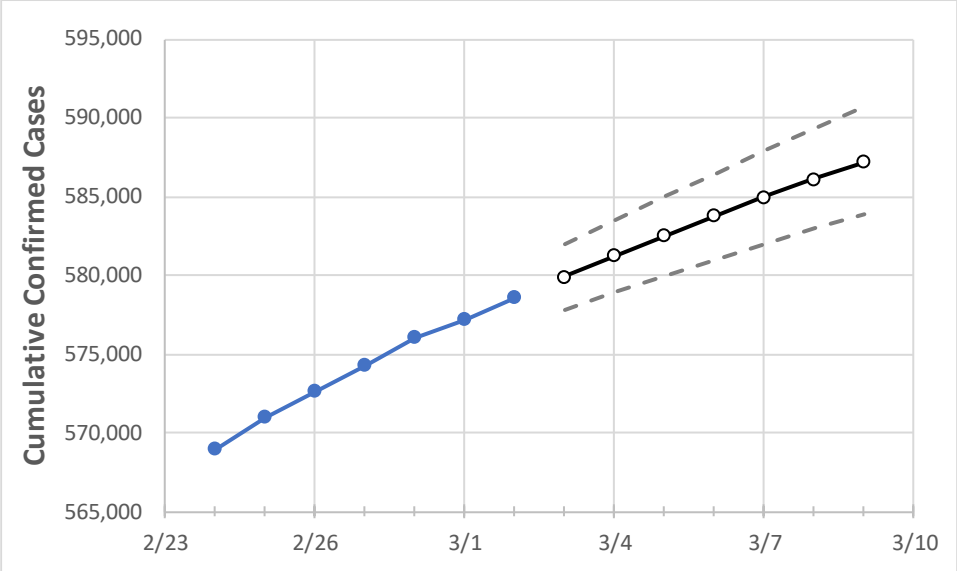
IEM's Modeling Lead

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Virginia	574,314	576,050	577,174	578,559	579,934	581,250	582,536	583,775	584,954	586,110	587,226

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Alexandria City	10,328	10,342	10,352	10,384	10,402	10,420	10,438	10,455	10,472	10,488	10,504
Arlington	13,151	13,182	13,215	13,255	13,291	13,327	13,362	13,398	13,433	13,467	13,502
Fairfax	67,415	67,547	67,670	67,847	68,006	68,159	68,311	68,460	68,604	68,742	68,880
Henrico	21,330	21,387	21,446	21,507	21,563	21,617	21,669	21,721	21,770	21,818	21,864
James City	3,846	3,867	3,880	3,868	3,877	3,886	3,894	3,903	3,911	3,919	3,927
Loudoun	23,076	23,126	23,183	23,221	23,269	23,315	23,360	23,405	23,448	23,490	23,530
Prince William	44,459	44,529	44,608	44,709	44,787	44,864	44,940	45,012	45,082	45,148	45,216
Virginia Beach City	30,491	30,595	30,652	30,739	30,823	30,904	30,979	31,055	31,126	31,197	31,265

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:		
	2/27	2/28	3/1	3/2	3/4	3/6	3/8
Alexandria City	10,328	10,342	10,352	10,384	10,420 (2,084) [500] {250}	10,455 (2,091) [502] {251}	10,488 (2,098) [503] {252}
Arlington	13,151	13,182	13,215	13,255	13,327 (2,665) [640] {320}	13,398 (2,680) [643] {322}	13,467 (2,693) [646] {323}
Fairfax	67,415	67,547	67,670	67,847	68,159 (13,632) [3,272] {1,636}	68,460 (13,692) [3,286] {1,643}	68,742 (13,748) [3,300] {1,650}
Henrico	21,330	21,387	21,446	21,507	21,617 (4,323) [1,038] {519}	21,721 (4,344) [1,043] {521}	21,818 (4,364) [1,047] {524}
James City	3,846	3,867	3,880	3,868	3,886 (777) [187] {93}	3,903 (781) [187] {94}	3,919 (784) [188] {94}
Loudoun	23,076	23,126	23,183	23,221	23,315 (4,663) [1,119] {560}	23,405 (4,681) [1,123] {562}	23,490 (4,698) [1,128] {564}
Prince William	44,459	44,529	44,608	44,709	44,864 (8,973) [2,153] {1,077}	45,012 (9,002) [2,161] {1,080}	45,148 (9,030) [2,167] {1,084}
Virginia Beach City	30,491	30,595	30,652	30,739	30,904 (6,181) [1,483] {742}	31,055 (6,211) [1,491] {745}	31,197 (6,239) [1,497] {749}

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.