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

Date: 3/5/21

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 3/5/21 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.

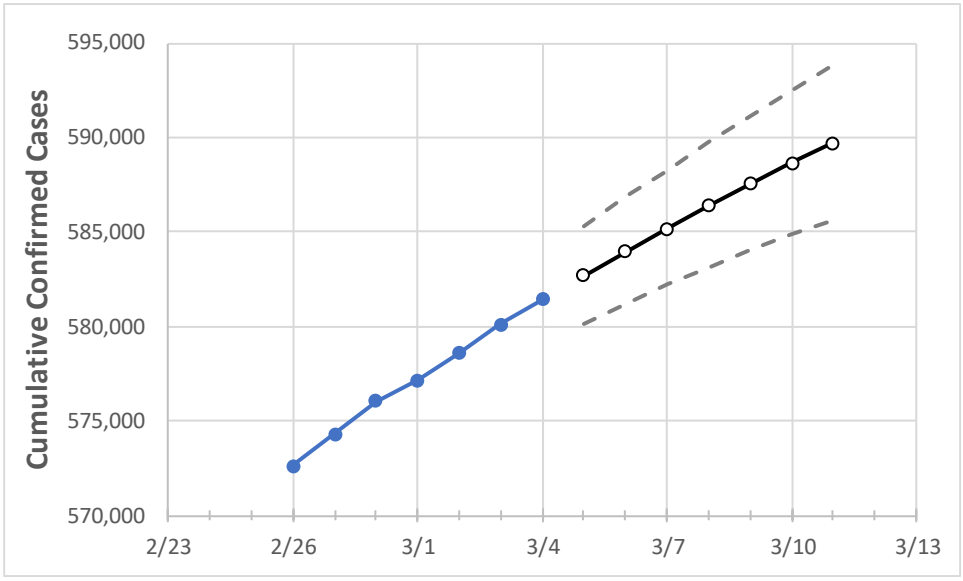
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Virginia	577,174	578,559	580,108	581,408	582,718	583,970	585,200	586,378	587,522	588,634	589,716

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Alexandria City	10,352	10,384	10,389	10,404	10,419	10,434	10,449	10,463	10,476	10,489	10,502
Arlington	13,215	13,255	13,294	13,342	13,379	13,415	13,450	13,486	13,521	13,556	13,591
Fairfax	67,670	67,847	68,042	68,250	68,404	68,560	68,714	68,857	69,003	69,142	69,277
Henrico	21,446	21,507	21,585	21,571	21,624	21,677	21,727	21,776	21,824	21,869	21,915
James City	3,880	3,868	3,876	3,886	3,895	3,904	3,913	3,921	3,930	3,938	3,946
Loudoun	23,183	23,221	23,272	23,352	23,400	23,449	23,496	23,541	23,585	23,627	23,669
Prince William	44,608	44,709	44,812	44,925	45,006	45,085	45,163	45,240	45,313	45,383	45,450
Virginia Beach City	30,652	30,739	30,838	30,929	31,011	31,091	31,165	31,238	31,309	31,379	31,443

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:		
	3/1	3/2	3/3	3/4	3/6	3/8	3/10
Alexandria City	10,352	10,384	10,389	10,404	10,434 (2,087) [501] {250}	10,463 (2,093) [502] {251}	10,489 (2,098) [503] {252}
Arlington	13,215	13,255	13,294	13,342	13,415 (2,683) [644] {322}	13,486 (2,697) [647] {324}	13,556 (2,711) [651] {325}
Fairfax	67,670	67,847	68,042	68,250	68,560 (13,712) [3,291] {1,645}	68,857 (13,771) [3,305] {1,653}	69,142 (13,828) [3,319] {1,659}
Henrico	21,446	21,507	21,585	21,571	21,677 (4,335) [1,041] {520}	21,776 (4,355) [1,045] {523}	21,869 (4,374) [1,050] {525}
James City	3,880	3,868	3,876	3,886	3,904 (781) [187] {94}	3,921 (784) [188] {94}	3,938 (788) [189] {95}
Loudoun	23,183	23,221	23,272	23,352	23,449 (4,690) [1,126] {563}	23,541 (4,708) [1,130] {565}	23,627 (4,725) [1,134] {567}
Prince William	44,608	44,709	44,812	44,925	45,085 (9,017) [2,164] {1,082}	45,240 (9,048) [2,172] {1,086}	45,383 (9,077) [2,178] {1,089}
Virginia Beach City	30,652	30,739	30,838	30,929	31,091 (6,218) [1,492] {746}	31,238 (6,248) [1,499] {750}	31,379 (6,276) [1,506] {753}

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.