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

Date: 3/12/21

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 3/12/21 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.

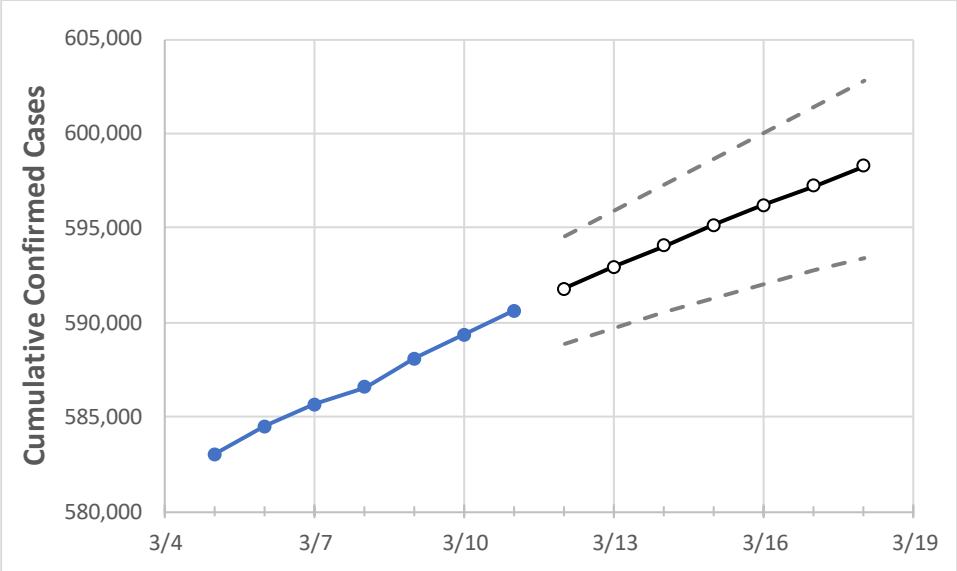
IEM's Modeling Lead

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Virginia	586,592	588,129	589,375	590,625	591,798	592,943	594,080	595,157	596,203	597,257	598,286

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Alexandria City	10,468	10,490	10,504	10,529	10,544	10,558	10,572	10,586	10,600	10,613	10,626
Arlington	13,481	13,501	13,526	13,559	13,590	13,620	13,649	13,679	13,708	13,736	13,763
Fairfax	68,806	68,932	69,070	69,213	69,346	69,478	69,606	69,732	69,853	69,972	70,088
Henrico	21,785	21,853	21,884	21,917	21,963	22,008	22,052	22,095	22,137	22,177	22,216
James City	3,942	3,950	3,968	3,980	3,992	4,003	4,015	4,026	4,038	4,050	4,061
Loudoun	23,589	23,641	23,708	23,782	23,841	23,899	23,957	24,014	24,072	24,131	24,189
Prince William	45,238	45,309	45,363	45,458	45,530	45,602	45,671	45,740	45,803	45,869	45,932
Virginia Beach City	31,182	31,300	31,423	31,505	31,578	31,649	31,719	31,788	31,855	31,922	31,985

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:		
	3/8	3/9	3/10	3/11	3/13	3/15	3/17
Alexandria City	10,468	10,490	10,504	10,529	10,558 (2,112) [507] {253}	10,586 (2,117) [508] {254}	10,613 (2,123) [509] {255}
Arlington	13,481	13,501	13,526	13,559	13,620 (2,724) [654] {327}	13,679 (2,736) [657] {328}	13,736 (2,747) [659] {330}
Fairfax	68,806	68,932	69,070	69,213	69,478 (13,896) [3,335] {1,667}	69,732 (13,946) [3,347] {1,674}	69,972 (13,994) [3,359] {1,679}
Henrico	21,785	21,853	21,884	21,917	22,008 (4,402) [1,056] {528}	22,095 (4,419) [1,061] {530}	22,177 (4,435) [1,065] {532}
James City	3,942	3,950	3,968	3,980	4,003 (801) [192] {96}	4,026 (805) [193] {97}	4,050 (810) [194] {97}
Loudoun	23,589	23,641	23,708	23,782	23,899 (4,780) [1,147] {574}	24,014 (4,803) [1,153] {576}	24,131 (4,826) [1,158] {579}
Prince William	45,238	45,309	45,363	45,458	45,602 (9,120) [2,189] {1,094}	45,740 (9,148) [2,196] {1,098}	45,869 (9,174) [2,202] {1,101}
Virginia Beach City	31,182	31,300	31,423	31,505	31,649 (6,330) [1,519] {760}	31,788 (6,358) [1,526] {763}	31,922 (6,384) [1,532] {766}

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.