IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/14/22

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 1/14/22 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
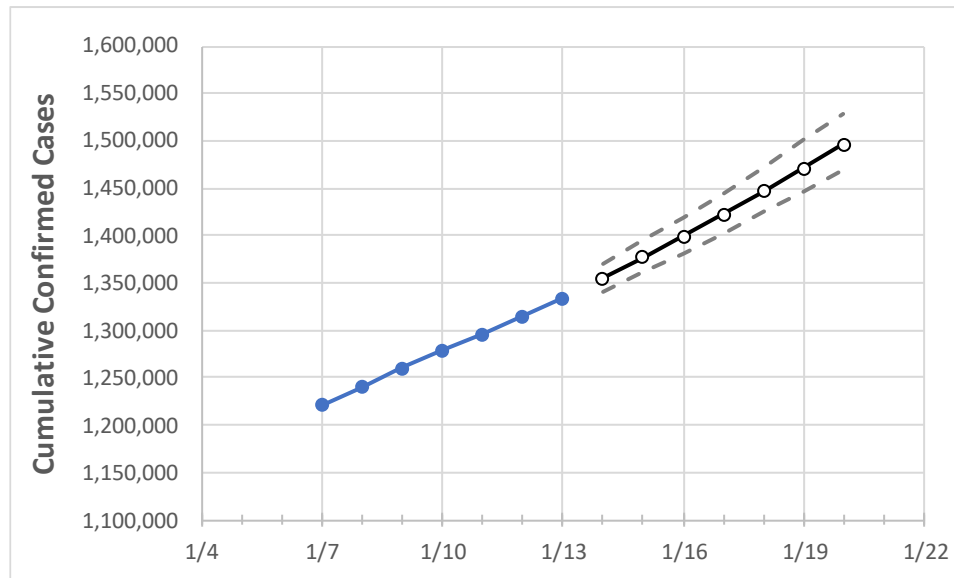
	Actual Confirmed Cases On:				Projected Cases For:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Virginia	1,278,739	1,295,420	1,315,256	1,334,198	1,355,392	1,377,072	1,399,170	1,422,387	1,446,451	1,471,123	1,496,547

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Alexandria City	23,737	24,210	24,719	25,027	25,505	25,985	26,473	26,959	27,433	27,940	28,433
Arlington	31,794	32,520	33,073	33,426	34,028	34,651	35,269	35,890	36,528	37,218	37,855
Fairfax	143,754	146,505	148,926	150,864	153,470	156,109	158,766	161,553	164,329	167,193	170,123
Henrico	49,176	49,903	50,648	51,281	52,032	52,788	53,561	54,346	55,145	55,961	56,798
James City	10,587	10,739	10,919	11,227	11,520	11,832	12,146	12,485	12,843	13,216	13,600
Loudoun	53,685	54,613	55,231	55,773	56,662	57,552	58,453	59,364	60,310	61,279	62,259
Prince William	88,540	90,186	91,327	92,276	93,643	95,026	96,457	97,894	99,375	100,847	102,369
Virginia Beach City	69,171	70,170	71,284	72,563	74,094	75,692	77,370	79,147	81,004	82,960	85,103

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:		
	1/10	1/11	1/12	1/13	1/15	1/17	1/19
Alexandria City	23,737	24,210	24,719	25,027	25,985 (5,197) [1,247] {624}	26,959 (5,392) [1,294] {647}	27,940 (5,588) [1,341] {671}
Arlington	31,794	32,520	33,073	33,426	34,651 (6,930) [1,663] {832}	35,890 (7,178) [1,723] {861}	37,218 (7,444) [1,786] {893}
Fairfax	143,754	146,505	148,926	150,864	156,109 (31,222) [7,493] {3,747}	161,553 (32,311) [7,755] {3,877}	167,193 (33,439) [8,025] {4,013}
Henrico	49,176	49,903	50,648	51,281	52,788 (10,558) [2,534] {1,267}	54,346 (10,869) [2,609] {1,304}	55,961 (11,192) [2,686] {1,343}
James City	10,587	10,739	10,919	11,227	11,832 (2,366) [568] {284}	12,485 (2,497) [599] {300}	13,216 (2,643) [634] {317}
Loudoun	53,685	54,613	55,231	55,773	57,552 (11,510) [2,763] {1,381}	59,364 (11,873) [2,849] {1,425}	61,279 (12,256) [2,941] {1,471}
Prince William	88,540	90,186	91,327	92,276	95,026 (19,005) [4,561] {2,281}	97,894 (19,579) [4,699] {2,349}	100,847 (20,169) [4,841] {2,420}
Virginia Beach City	69,171	70,170	71,284	72,563	75,692 (15,138) [3,633] {1,817}	79,147 (15,829) [3,799] {1,900}	82,960 (16,592) [3,982] {1,991}

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.