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

Date: 4/13/21

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 4/13/21 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.

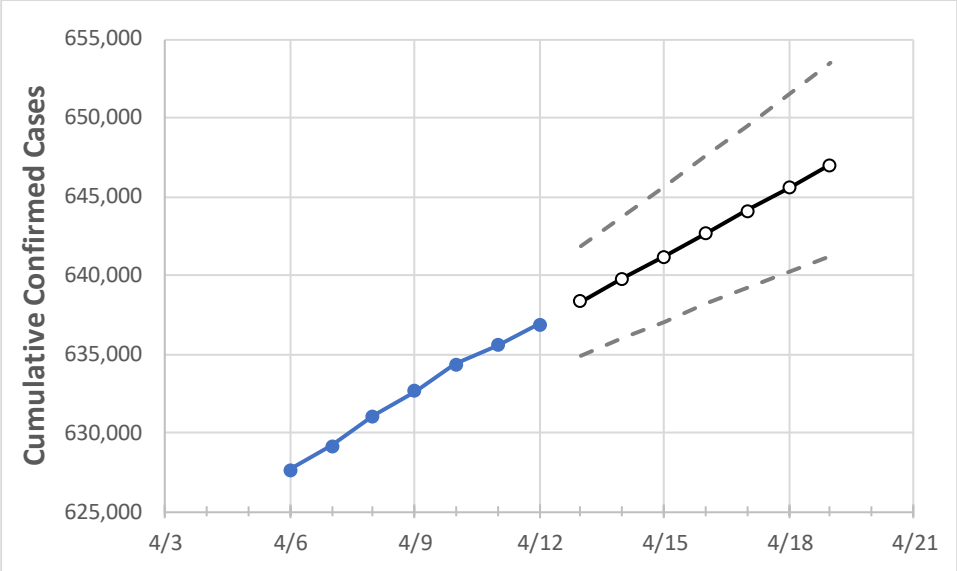
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Virginia	632,625	634,325	635,552	636,862	638,310	639,763	641,187	642,637	644,098	645,563	647,037

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Alexandria City	11,253	11,277	11,325	11,348	11,384	11,420	11,457	11,494	11,532	11,571	11,611
Arlington	14,631	14,646	14,679	14,697	14,731	14,764	14,796	14,828	14,860	14,891	14,922
Fairfax	74,088	74,259	74,455	74,689	74,881	75,076	75,272	75,475	75,679	75,890	76,100
Henrico	23,793	23,856	23,923	23,984	24,050	24,116	24,183	24,250	24,316	24,385	24,450
James City	4,362	4,367	4,373	4,393	4,404	4,416	4,427	4,439	4,450	4,461	4,473
Loudoun	26,116	26,169	26,243	26,379	26,472	26,565	26,660	26,755	26,850	26,950	27,050
Prince William	48,435	48,519	48,654	48,787	48,907	49,030	49,156	49,278	49,402	49,534	49,666
Virginia Beach City	33,866	33,960	34,010	34,068	34,138	34,209	34,279	34,347	34,414	34,481	34,547

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:		
	4/9	4/10	4/11	4/12	4/14	4/16	4/18
Alexandria City	11,253	11,277	11,325	11,348	11,420 (2,284) [548] {274}	11,494 (2,299) [552] {276}	11,571 (2,314) [555] {278}
Arlington	14,631	14,646	14,679	14,697	14,764 (2,953) [709] {354}	14,828 (2,966) [712] {356}	14,891 (2,978) [715] {357}
Fairfax	74,088	74,259	74,455	74,689	75,076 (15,015) [3,604] {1,802}	75,475 (15,095) [3,623] {1,811}	75,890 (15,178) [3,643] {1,821}
Henrico	23,793	23,856	23,923	23,984	24,116 (4,823) [1,158] {579}	24,250 (4,850) [1,164] {582}	24,385 (4,877) [1,170] {585}
James City	4,362	4,367	4,373	4,393	4,416 (883) [212] {106}	4,439 (888) [213] {107}	4,461 (892) [214] {107}
Loudoun	26,116	26,169	26,243	26,379	26,565 (5,313) [1,275] {638}	26,755 (5,351) [1,284] {642}	26,950 (5,390) [1,294] {647}
Prince William	48,435	48,519	48,654	48,787	49,030 (9,806) [2,353] {1,177}	49,278 (9,856) [2,365] {1,183}	49,534 (9,907) [2,378] {1,189}
Virginia Beach City	33,866	33,960	34,010	34,068	34,209 (6,842) [1,642] {821}	34,347 (6,869) [1,649] {824}	34,481 (6,896) [1,655] {828}

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.