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

Date: 1/12/21

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 1/12/21 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.

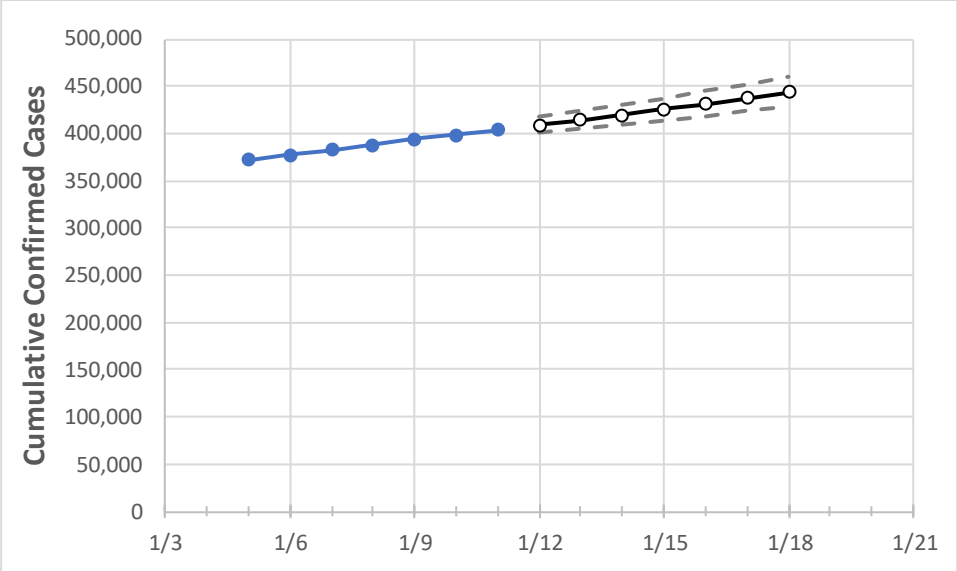
IEM's Modeling Lead

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Virginia	387,917	393,715	398,856	403,386	408,841	414,430	420,033	425,781	431,618	437,534	443,636

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Alexandria City	7,985	8,087	8,156	8,248	8,337	8,425	8,519	8,617	8,717	8,819	8,925
Arlington	9,847	9,997	10,117	10,202	10,314	10,431	10,551	10,675	10,796	10,923	11,056
Fairfax	48,981	49,634	50,379	50,826	51,427	52,037	52,672	53,324	53,987	54,675	55,370
Henrico	13,983	14,173	14,379	14,567	14,795	15,026	15,262	15,505	15,757	16,015	16,277
James City	2,218	2,254	2,318	2,355	2,400	2,447	2,495	2,544	2,595	2,648	2,703
Loudoun	15,286	15,368	15,443	15,604	15,714	15,822	15,926	16,026	16,137	16,243	16,343
Prince William	32,126	32,362	32,676	32,962	33,254	33,549	33,844	34,135	34,441	34,732	35,032
Virginia Beach City	19,314	19,718	20,102	20,420	20,843	21,280	21,740	22,211	22,721	23,223	23,760

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:		
	1/8	1/9	1/10	1/11	1/13	1/15	1/17
Alexandria City	7,985	8,087	8,156	8,248	8,425 (1,685) [404] {202}	8,617 (1,723) [414] {207}	8,819 (1,764) [423] {212}
Arlington	9,847	9,997	10,117	10,202	10,431 (2,086) [501] {250}	10,675 (2,135) [512] {256}	10,923 (2,185) [524] {262}
Fairfax	48,981	49,634	50,379	50,826	52,037 (10,407) [2,498] {1,249}	53,324 (10,665) [2,560] {1,280}	54,675 (10,935) [2,624] {1,312}
Henrico	13,983	14,173	14,379	14,567	15,026 (3,005) [721] {361}	15,505 (3,101) [744] {372}	16,015 (3,203) [769] {384}
James City	2,218	2,254	2,318	2,355	2,447 (489) [117] {59}	2,544 (509) [122] {61}	2,648 (530) [127] {64}
Loudoun	15,286	15,368	15,443	15,604	15,822 (3,164) [759] {380}	16,026 (3,205) [769] {385}	16,243 (3,249) [780] {390}
Prince William	32,126	32,362	32,676	32,962	33,549 (6,710) [1,610] {805}	34,135 (6,827) [1,638] {819}	34,732 (6,946) [1,667] {834}
Virginia Beach City	19,314	19,718	20,102	20,420	21,280 (4,256) [1,021] {511}	22,211 (4,442) [1,066] {533}	23,223 (4,645) [1,115] {557}

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.