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

Date: 12/8/21

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 12/8/21 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.

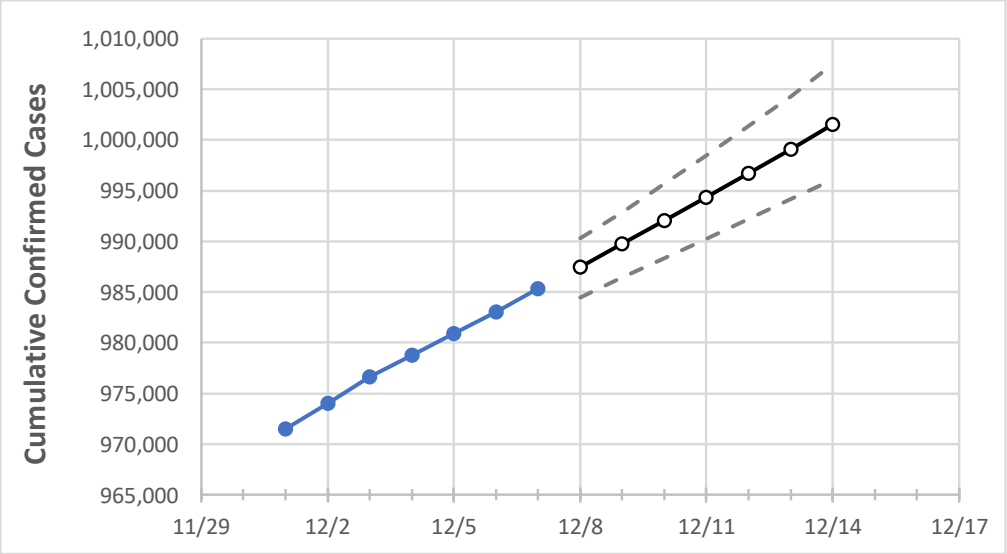
IEM's Modeling Lead

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Virginia	978,751	980,903	983,055	985,297	987,488	989,750	992,010	994,345	996,714	999,118	1,001,556

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Alexandria City	14,985	15,016	15,056	15,105	15,140	15,176	15,213	15,252	15,293	15,333	15,376
Arlington	19,776	19,828	19,893	19,952	20,004	20,061	20,117	20,175	20,236	20,298	20,361
Fairfax	97,829	97,999	98,154	98,499	98,695	98,891	99,102	99,306	99,520	99,743	99,955
Henrico	36,323	36,427	36,530	36,603	36,707	36,814	36,923	37,036	37,153	37,275	37,399
James City	7,507	7,524	7,540	7,563	7,583	7,603	7,623	7,645	7,666	7,687	7,709
Loudoun	36,478	36,571	36,677	36,816	36,923	37,032	37,143	37,258	37,373	37,496	37,616
Prince William	64,318	64,423	64,540	64,745	64,858	64,976	65,090	65,211	65,333	65,465	65,586
Virginia Beach City	51,849	51,941	52,034	52,138	52,239	52,344	52,452	52,562	52,677	52,794	52,916

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:		
	12/4	12/5	12/6	12/7	12/9	12/11	12/13
Alexandria City	14,985	15,016	15,056	15,105	15,176 (3,035) [728] {364}	15,252 (3,050) [732] {366}	15,333 (3,067) [736] {368}
Arlington	19,776	19,828	19,893	19,952	20,061 (4,012) [963] {481}	20,175 (4,035) [968] {484}	20,298 (4,060) [974] {487}
Fairfax	97,829	97,999	98,154	98,499	98,891 (19,778) [4,747] {2,373}	99,306 (19,861) [4,767] {2,383}	99,743 (19,949) [4,788] {2,394}
Henrico	36,323	36,427	36,530	36,603	36,814 (7,363) [1,767] {884}	37,036 (7,407) [1,778] {889}	37,275 (7,455) [1,789] {895}
James City	7,507	7,524	7,540	7,563	7,603 (1,521) [365] {182}	7,645 (1,529) [367] {183}	7,687 (1,537) [369] {184}
Loudoun	36,478	36,571	36,677	36,816	37,032 (7,406) [1,778] {889}	37,258 (7,452) [1,788] {894}	37,496 (7,499) [1,800] {900}
Prince William	64,318	64,423	64,540	64,745	64,976 (12,995) [3,119] {1,559}	65,211 (13,042) [3,130] {1,565}	65,465 (13,093) [3,142] {1,571}
Virginia Beach City	51,849	51,941	52,034	52,138	52,344 (10,469) [2,513] {1,256}	52,562 (10,512) [2,523] {1,261}	52,794 (10,559) [2,534] {1,267}

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.