IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/29/22

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 <u>not</u> 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 3/29/22 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
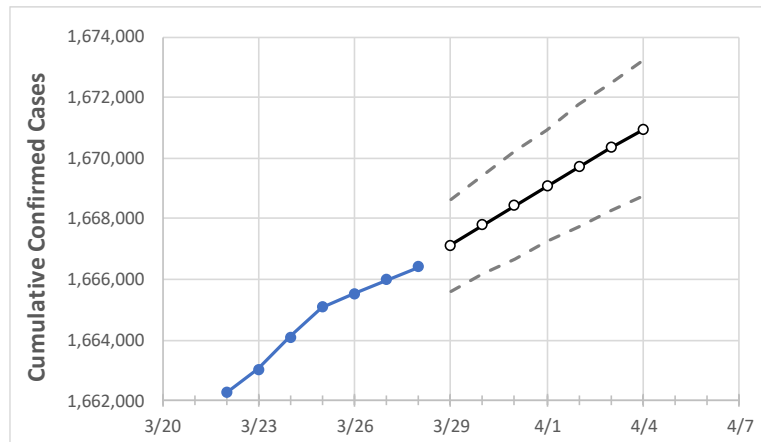
	Actual Confirmed Cases On:				Projected Cases For:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Virginia	1,665,082	1,665,529	1,665,975	1,666,422	1,667,115	1,667,785	1,668,420	1,669,073	1,669,697	1,670,346	1,670,937

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Alexandria City	30,045	30,064	30,083	30,083	30,100	30,118	30,135	30,152	30,169	30,186	30,204
Arlington	41,049	41,085	41,120	41,120	41,163	41,207	41,252	41,297	41,341	41,388	41,434
Fairfax	179,063	179,169	179,418	179,418	179,506	179,591	179,677	179,764	179,853	179,941	180,028
Henrico	64,025	64,038	64,050	64,063	64,086	64,109	64,131	64,153	64,175	64,197	64,220
James City	14,766	14,768	14,771	14,773	14,777	14,781	14,784	14,788	14,791	14,795	14,799
Loudoun	67,629	67,654	67,679	67,679	67,758	67,837	67,915	67,997	68,069	68,149	68,229
Prince William	107,218	107,269	107,355	107,355	107,423	107,493	107,569	107,650	107,734	107,822	107,914
Virginia Beach City	88,930	88,941	88,951	88,962	88,975	88,989	89,002	89,014	89,026	89,039	89,050

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Alexandria City	30,045	30,064	30,083	30,083	30,118 (6,024) [1,446] {723}	30,152 (6,030) [1,447] {724}	30,186 (6,037) [1,449] {724}
Arlington	41,049	41,085	41,120	41,120	41,207 (8,241) [1,978] {989}	41,297 (8,259) [1,982] {991}	41,388 (8,278) [1,987] {993}
Fairfax	179,063	179,169	179,418	179,418	179,591 (35,918) [8,620] {4,310}	179,764 (35,953) [8,629] {4,314}	179,941 (35,988) [8,637] {4,319}
Henrico	64,025	64,038	64,050	64,063	64,109 (12,822) [3,077] {1,539}	64,153 (12,831) [3,079] {1,540}	64,197 (12,839) [3,081] {1,541}
James City	14,766	14,768	14,771	14,773	14,781 (2,956) [709] {355}	14,788 (2,958) [710] {355}	14,795 (2,959) [710] {355}
Loudoun	67,629	67,654	67,679	67,679	67,837 (13,567) [3,256] {1,628}	67,997 (13,599) [3,264] {1,632}	68,149 (13,630) [3,271] {1,636}
Prince William	107,218	107,269	107,355	107,355	107,493 (21,499) [5,160] {2,580}	107,650 (21,530) [5,167] {2,584}	107,822 (21,564) [5,175] {2,588}
Virginia Beach City	88,930	88,941	88,951	88,962	88,989 (17,798) [4,271] {2,136}	89,014 (17,803) [4,273] {2,136}	89,039 (17,808) [4,274] {2,137}

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.