IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/7/21

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 4/7/21 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
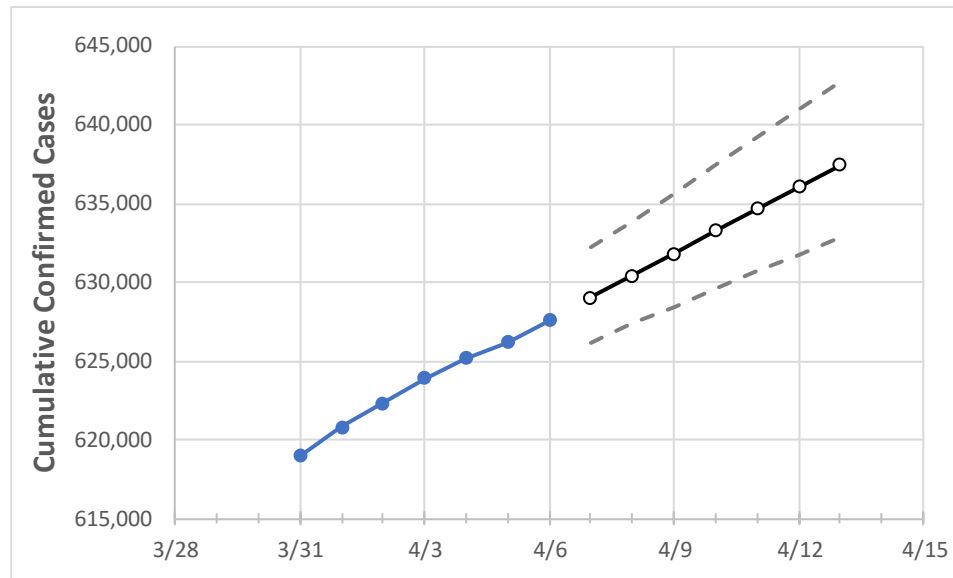
	Actual Confirmed Cases On:				Projected Cases For:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Virginia	623,881	625,148	626,171	627,605	629,020	630,423	631,834	633,259	634,668	636,060	637,471

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Alexandria City	11,046	11,077	11,100	11,136	11,162	11,188	11,214	11,241	11,269	11,296	11,324
Arlington	14,412	14,436	14,464	14,490	14,528	14,566	14,604	14,642	14,679	14,717	14,755
Fairfax	73,048	73,175	73,319	73,483	73,650	73,817	73,985	74,150	74,318	74,482	74,645
Henrico	23,423	23,488	23,549	23,592	23,664	23,737	23,810	23,886	23,961	24,035	24,109
James City	4,303	4,318	4,324	4,318	4,332	4,347	4,361	4,376	4,392	4,408	4,423
Loudoun	25,572	25,623	25,693	25,794	25,867	25,943	26,020	26,095	26,170	26,245	26,320
Prince William	47,755	47,837	47,928	48,038	48,150	48,259	48,374	48,483	48,603	48,721	48,839
Virginia Beach City	33,412	33,482	33,538	33,615	33,688	33,761	33,834	33,905	33,975	34,044	34,115

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:		
	4/3	4/4	4/5	4/6	4/8	4/10	4/12
Alexandria City	11,046	11,077	11,100	11,136	11,188 (2,238) [537] {269}	11,241 (2,248) [540] {270}	11,296 (2,259) [542] {271}
Arlington	14,412	14,436	14,464	14,490	14,566 (2,913) [699] {350}	14,642 (2,928) [703] {351}	14,717 (2,943) [706] {353}
Fairfax	73,048	73,175	73,319	73,483	73,817 (14,763) [3,543] {1,772}	74,150 (14,830) [3,559] {1,780}	74,482 (14,896) [3,575] {1,788}
Henrico	23,423	23,488	23,549	23,592	23,737 (4,747) [1,139] {570}	23,886 (4,777) [1,147] {573}	24,035 (4,807) [1,154] {577}
James City	4,303	4,318	4,324	4,318	4,347 (869) [209] {104}	4,376 (875) [210] {105}	4,408 (882) [212] {106}
Loudoun	25,572	25,623	25,693	25,794	25,943 (5,189) [1,245] {623}	26,095 (5,219) [1,253] {626}	26,245 (5,249) [1,260] {630}
Prince William	47,755	47,837	47,928	48,038	48,259 (9,652) [2,316] {1,158}	48,483 (9,697) [2,327] {1,164}	48,721 (9,744) [2,339] {1,169}
Virginia Beach City	33,412	33,482	33,538	33,615	33,761 (6,752) [1,621] {810}	33,905 (6,781) [1,627] {814}	34,044 (6,809) [1,634] {817}

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.