IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/22/21

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 <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 3/22/21 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.

Maryland State Projections
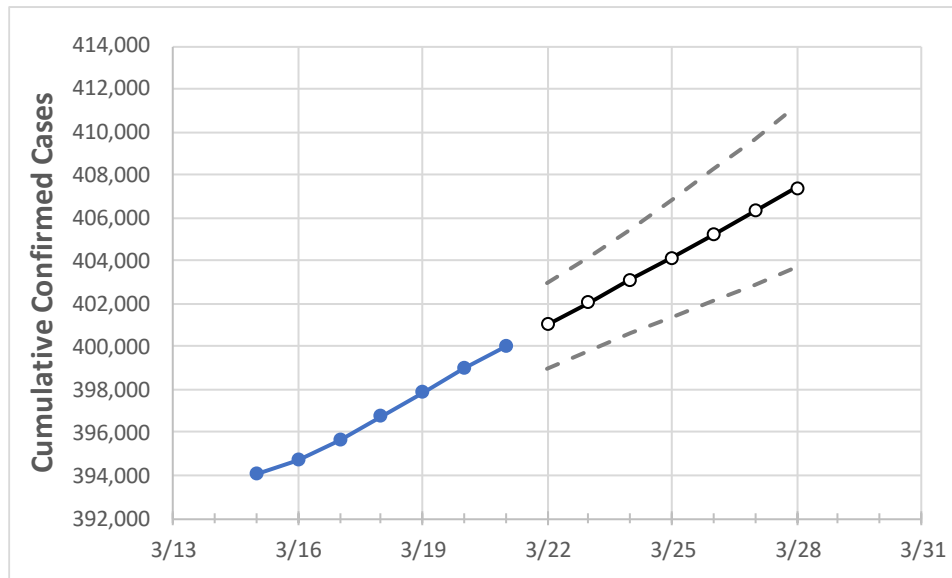
	Actual Confirmed Cases On:				**Projected Cases For:**						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Maryland	396,746	397,898	399,016	400,023	401,027	402,056	403,108	404,160	405,227	406,307	407,399

Note: The State'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.

Maryland Counties

	Actual Confirmed Cases On:				**Projected Cases For:**						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Anne Arundel	37,295	37,450	37,629	37,722	37,834	37,951	38,069	38,188	38,310	38,437	38,562
Baltimore City	42,230	42,418	42,550	42,736	42,915	43,105	43,299	43,504	43,719	43,944	44,176
Baltimore County	53,282	53,445	53,628	53,801	53,967	54,135	54,302	54,477	54,653	54,834	55,016
Charles	9,391	9,428	9,451	9,465	9,492	9,520	9,547	9,575	9,602	9,631	9,659
Frederick	17,646	17,686	17,745	17,772	17,814	17,856	17,899	17,942	17,985	18,029	18,073
Harford	13,187	13,243	13,294	13,350	13,406	13,464	13,524	13,586	13,650	13,715	13,783
Howard	16,621	16,649	16,710	16,741	16,786	16,826	16,869	16,912	16,955	16,998	17,039
Montgomery	65,289	65,408	65,505	65,596	65,702	65,811	65,917	66,024	66,128	66,236	66,341
Prince George's	76,022	76,196	76,370	76,481	76,628	76,771	76,917	77,060	77,201	77,341	77,482

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.*

Maryland Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	3/18	3/19	3/20	3/21	3/23	3/25	3/27
Anne Arundel	37,295	37,450	37,629	37,722	37,951 (7,590) [1,822] {911}	38,188 (7,638) [1,833] {917}	38,437 (7,687) [1,845] {922}
Baltimore City	42,230	42,418	42,550	42,736	43,105 (8,621) [2,069] {1,035}	43,504 (8,701) [2,088] {1,044}	43,944 (8,789) [2,109] {1,055}
Baltimore County	53,282	53,445	53,628	53,801	54,135 (10,827) [2,598] {1,299}	54,477 (10,895) [2,615] {1,307}	54,834 (10,967) [2,632] {1,316}
Charles	9,391	9,428	9,451	9,465	9,520 (1,904) [457] {228}	9,575 (1,915) [460] {230}	9,631 (1,926) [462] {231}
Frederick	17,646	17,686	17,745	17,772	17,856 (3,571) [857] {429}	17,942 (3,588) [861] {431}	18,029 (3,606) [865] {433}
Harford	13,187	13,243	13,294	13,350	13,464 (2,693) [646] {323}	13,586 (2,717) [652] {326}	13,715 (2,743) [658] {329}
Howard	16,621	16,649	16,710	16,741	16,826 (3,365) [808] {404}	16,912 (3,382) [812] {406}	16,998 (3,400) [816] {408}
Montgomery	65,289	65,408	65,505	65,596	65,811 (13,162) [3,159] {1,579}	66,024 (13,205) [3,169] {1,585}	66,236 (13,247) [3,179] {1,590}
Prince George's	76,022	76,196	76,370	76,481	76,771 (15,354) [3,685] {1,842}	77,060 (15,412) [3,699] {1,849}	77,341 (15,468) [3,712] {1,856}

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.