IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/24/21

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 3/24/21 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
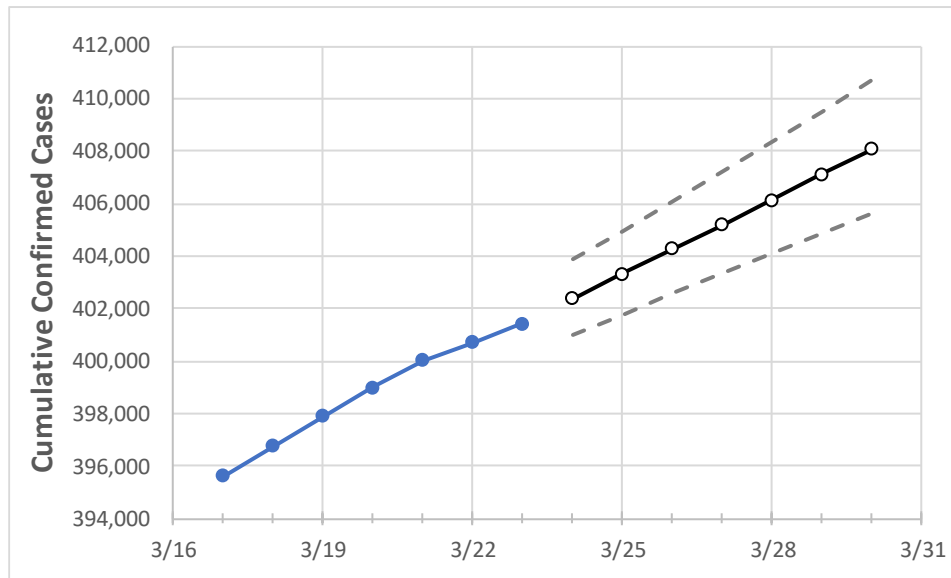
	Actual Confirmed Cases On:				Projected Cases For:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Maryland	399,016	400,023	400,705	401,427	402,363	403,316	404,265	405,198	406,156	407,124	408,093

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Anne Arundel	37,629	37,722	37,799	37,879	37,981	38,088	38,194	38,302	38,411	38,524	38,633
Baltimore City	42,550	42,736	42,839	42,970	43,141	43,317	43,495	43,678	43,870	44,067	44,268
Baltimore County	53,628	53,801	53,914	54,031	54,189	54,350	54,514	54,679	54,842	55,007	55,173
Charles	9,451	9,465	9,484	9,531	9,560	9,589	9,618	9,647	9,676	9,705	9,734
Frederick	17,745	17,772	17,788	17,838	17,877	17,917	17,958	17,999	18,040	18,080	18,121
Harford	13,294	13,350	13,376	13,415	13,468	13,522	13,576	13,631	13,687	13,743	13,801
Howard	16,710	16,741	16,776	16,798	16,835	16,871	16,909	16,945	16,980	17,016	17,052
Montgomery	65,505	65,596	65,686	65,825	65,934	66,043	66,153	66,260	66,369	66,479	66,589
Prince George's	76,370	76,481	76,587	76,750	76,891	77,032	77,170	77,309	77,447	77,587	77,725

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Anne Arundel	37,629	37,722	37,799	37,879	38,088 (7,618) [1,828] {914}	38,302 (7,660) [1,839] {919}	38,524 (7,705) [1,849] {925}
Baltimore City	42,550	42,736	42,839	42,970	43,317 (8,663) [2,079] {1,040}	43,678 (8,736) [2,097] {1,048}	44,067 (8,813) [2,115] {1,058}
Baltimore County	53,628	53,801	53,914	54,031	54,350 (10,870) [2,609] {1,304}	54,679 (10,936) [2,625] {1,312}	55,007 (11,001) [2,640] {1,320}
Charles	9,451	9,465	9,484	9,531	9,589 (1,918) [460] {230}	9,647 (1,929) [463] {232}	9,705 (1,941) [466] {233}
Frederick	17,745	17,772	17,788	17,838	17,917 (3,583) [860] {430}	17,999 (3,600) [864] {432}	18,080 (3,616) [868] {434}
Harford	13,294	13,350	13,376	13,415	13,522 (2,704) [649] {325}	13,631 (2,726) [654] {327}	13,743 (2,749) [660] {330}
Howard	16,710	16,741	16,776	16,798	16,871 (3,374) [810] {405}	16,945 (3,389) [813] {407}	17,016 (3,403) [817] {408}
Montgomery	65,505	65,596	65,686	65,825	66,043 (13,209) [3,170] {1,585}	66,260 (13,252) [3,180] {1,590}	66,479 (13,296) [3,191] {1,595}
Prince George's	76,370	76,481	76,587	76,750	77,032 (15,406) [3,698] {1,849}	77,309 (15,462) [3,711] {1,855}	77,587 (15,517) [3,724] {1,862}

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.