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

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 3/19/21 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
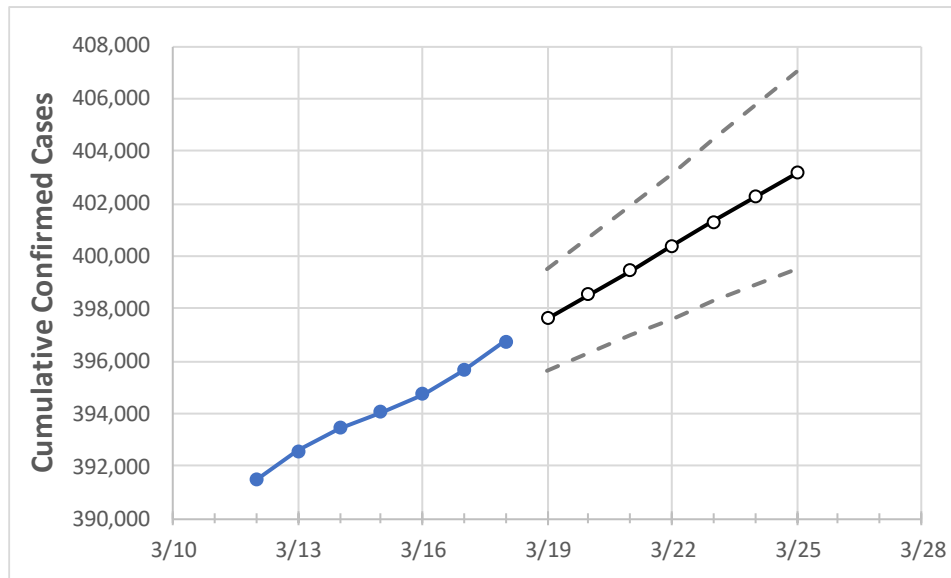
	Actual Confirmed Cases On:				Projected Cases For:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Maryland	394,058	394,716	395,633	396,746	397,638	398,542	399,461	400,395	401,323	402,249	403,183

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Anne Arundel	37,012	37,074	37,165	37,295	37,386	37,476	37,567	37,660	37,754	37,846	37,938
Baltimore City	41,814	41,906	42,036	42,230	42,386	42,549	42,719	42,891	43,071	43,257	43,454
Baltimore County	52,828	52,936	53,073	53,282	53,432	53,583	53,736	53,890	54,047	54,204	54,371
Charles	9,296	9,334	9,357	9,391	9,420	9,449	9,479	9,510	9,542	9,574	9,606
Frederick	17,524	17,545	17,593	17,646	17,687	17,728	17,769	17,811	17,854	17,897	17,942
Harford	13,042	13,075	13,119	13,187	13,239	13,292	13,348	13,405	13,464	13,525	13,587
Howard	16,501	16,544	16,585	16,621	16,669	16,717	16,765	16,812	16,860	16,909	16,958
Montgomery	64,934	65,053	65,157	65,289	65,401	65,511	65,623	65,735	65,848	65,960	66,074
Prince George's	75,541	75,719	75,847	76,022	76,163	76,304	76,442	76,580	76,719	76,856	76,998

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:		
	3/15	3/16	3/17	3/18	3/20	3/22	3/24
Anne Arundel	37,012	37,074	37,165	37,295	37,476 (7,495) [1,799] {899}	37,660 (7,532) [1,808] {904}	37,846 (7,569) [1,817] {908}
Baltimore City	41,814	41,906	42,036	42,230	42,549 (8,510) [2,042] {1,021}	42,891 (8,578) [2,059] {1,029}	43,257 (8,651) [2,076] {1,038}
Baltimore County	52,828	52,936	53,073	53,282	53,583 (10,717) [2,572] {1,286}	53,890 (10,778) [2,587] {1,293}	54,204 (10,841) [2,602] {1,301}
Charles	9,296	9,334	9,357	9,391	9,449 (1,890) [454] {227}	9,510 (1,902) [456] {228}	9,574 (1,915) [460] {230}
Frederick	17,524	17,545	17,593	17,646	17,728 (3,546) [851] {425}	17,811 (3,562) [855] {427}	17,897 (3,579) [859] {430}
Harford	13,042	13,075	13,119	13,187	13,292 (2,658) [638] {319}	13,405 (2,681) [643] {322}	13,525 (2,705) [649] {325}
Howard	16,501	16,544	16,585	16,621	16,717 (3,343) [802] {401}	16,812 (3,362) [807] {403}	16,909 (3,382) [812] {406}
Montgomery	64,934	65,053	65,157	65,289	65,511 (13,102) [3,145] {1,572}	65,735 (13,147) [3,155] {1,578}	65,960 (13,192) [3,166] {1,583}
Prince George's	75,541	75,719	75,847	76,022	76,304 (15,261) [3,663] {1,831}	76,580 (15,316) [3,676] {1,838}	76,856 (15,371) [3,689] {1,845}

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.