IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/22/21

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 9/22/21 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
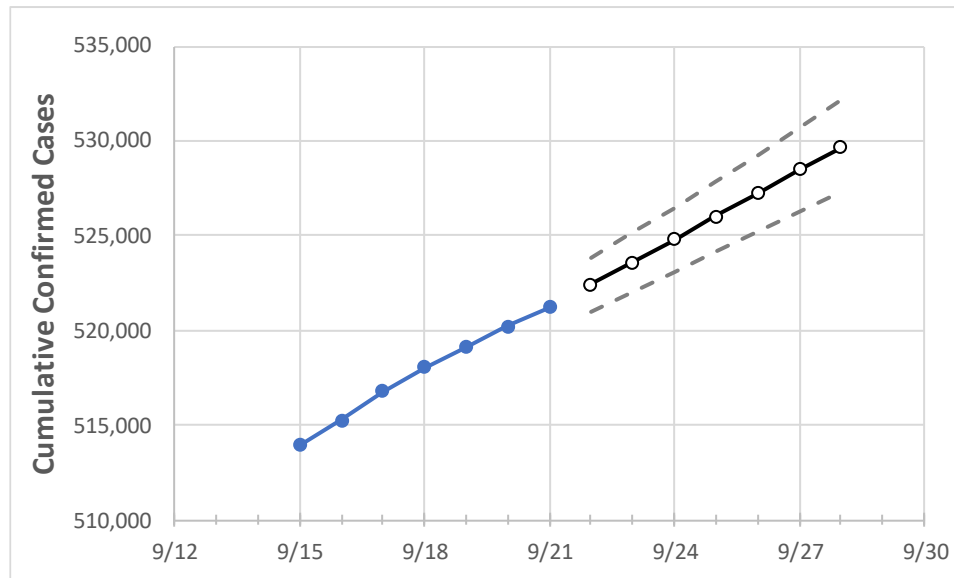
	Actual Confirmed Cases On:				Projected Cases For:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Maryland	518,061	519,097	520,236	521,210	522,421	523,611	524,800	526,012	527,239	528,476	529,658

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Anne Arundel	49,207	49,313	49,394	49,464	49,565	49,667	49,768	49,870	49,969	50,073	50,178
Baltimore City	57,673	57,773	57,895	57,962	58,058	58,152	58,251	58,347	58,447	58,548	58,647
Baltimore County	72,019	72,127	72,236	72,338	72,455	72,575	72,694	72,814	72,931	73,054	73,175
Charles	13,325	13,366	13,400	13,435	13,478	13,520	13,563	13,605	13,648	13,691	13,733
Frederick	22,510	22,556	22,612	22,648	22,699	22,750	22,800	22,851	22,902	22,953	23,005
Harford	18,814	18,849	18,892	18,938	18,984	19,031	19,076	19,123	19,171	19,218	19,265
Howard	21,422	21,436	21,492	21,518	21,559	21,600	21,641	21,683	21,725	21,765	21,808
Montgomery	78,530	78,635	78,755	78,852	78,974	79,099	79,218	79,339	79,463	79,588	79,706
Prince George's	95,001	95,144	95,287	95,446	95,602	95,760	95,913	96,072	96,226	96,383	96,533

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:		
	9/18	9/19	9/20	9/21	9/23	9/25	9/27
Anne Arundel	49,207	49,313	49,394	49,464	49,667 (9,933) [2,384] {1,192}	49,870 (9,974) [2,394] {1,197}	50,073 (10,015) [2,404] {1,202}
Baltimore City	57,673	57,773	57,895	57,962	58,152 (11,630) [2,791] {1,396}	58,347 (11,669) [2,801] {1,400}	58,548 (11,710) [2,810] {1,405}
Baltimore County	72,019	72,127	72,236	72,338	72,575 (14,515) [3,484] {1,742}	72,814 (14,563) [3,495] {1,748}	73,054 (14,611) [3,507] {1,753}
Charles	13,325	13,366	13,400	13,435	13,520 (2,704) [649] {324}	13,605 (2,721) [653] {327}	13,691 (2,738) [657] {329}
Frederick	22,510	22,556	22,612	22,648	22,750 (4,550) [1,092] {546}	22,851 (4,570) [1,097] {548}	22,953 (4,591) [1,102] {551}
Harford	18,814	18,849	18,892	18,938	19,031 (3,806) [913] {457}	19,123 (3,825) [918] {459}	19,218 (3,844) [922] {461}
Howard	21,422	21,436	21,492	21,518	21,600 (4,320) [1,037] {518}	21,683 (4,337) [1,041] {520}	21,765 (4,353) [1,045] {522}
Montgomery	78,530	78,635	78,755	78,852	79,099 (15,820) [3,797] {1,898}	79,339 (15,868) [3,808] {1,904}	79,588 (15,918) [3,820] {1,910}
Prince George's	95,001	95,144	95,287	95,446	95,760 (19,152) [4,596] {2,298}	96,072 (19,214) [4,611] {2,306}	96,383 (19,277) [4,626] {2,313}

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.