IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/10/21

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 2/10/21 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
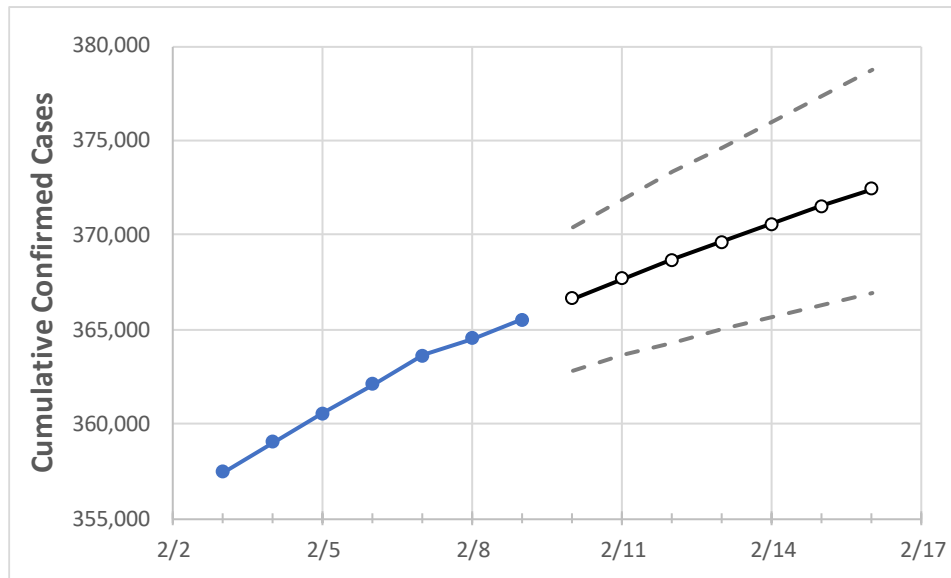
	Actual Confirmed Cases On:				Projected Cases For:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Maryland	362,084	363,650	364,553	365,529	366,637	367,684	368,686	369,657	370,615	371,552	372,456

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Anne Arundel	33,673	33,812	33,911	33,980	34,086	34,190	34,288	34,380	34,471	34,559	34,643
Baltimore City	38,584	38,733	38,828	38,909	39,004	39,097	39,189	39,276	39,364	39,448	39,526
Baltimore County	48,282	48,477	48,568	48,631	48,769	48,907	49,039	49,167	49,291	49,413	49,534
Charles	8,328	8,357	8,388	8,427	8,462	8,495	8,528	8,560	8,591	8,620	8,648
Frederick	16,057	16,100	16,159	16,190	16,238	16,286	16,330	16,371	16,411	16,452	16,491
Harford	11,637	11,714	11,765	11,791	11,835	11,879	11,921	11,961	12,000	12,037	12,074
Howard	14,877	14,952	14,981	15,037	15,084	15,132	15,177	15,220	15,262	15,302	15,343
Montgomery	60,479	60,633	60,835	61,001	61,171	61,326	61,483	61,636	61,773	61,908	62,045
Prince George's	69,600	69,779	70,020	70,244	70,449	70,646	70,842	71,033	71,215	71,391	71,563

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:		
	2/6	2/7	2/8	2/9	2/11	2/13	2/15
Anne Arundel	33,673	33,812	33,911	33,980	34,190 (6,838) [1,641] {821}	34,380 (6,876) [1,650] {825}	34,559 (6,912) [1,659] {829}
Baltimore City	38,584	38,733	38,828	38,909	39,097 (7,819) [1,877] {938}	39,276 (7,855) [1,885] {943}	39,448 (7,890) [1,894] {947}
Baltimore County	48,282	48,477	48,568	48,631	48,907 (9,781) [2,348] {1,174}	49,167 (9,833) [2,360] {1,180}	49,413 (9,883) [2,372] {1,186}
Charles	8,328	8,357	8,388	8,427	8,495 (1,699) [408] {204}	8,560 (1,712) [411] {205}	8,620 (1,724) [414] {207}
Frederick	16,057	16,100	16,159	16,190	16,286 (3,257) [782] {391}	16,371 (3,274) [786] {393}	16,452 (3,290) [790] {395}
Harford	11,637	11,714	11,765	11,791	11,879 (2,376) [570] {285}	11,961 (2,392) [574] {287}	12,037 (2,407) [578] {289}
Howard	14,877	14,952	14,981	15,037	15,132 (3,026) [726] {363}	15,220 (3,044) [731] {365}	15,302 (3,060) [735] {367}
Montgomery	60,479	60,633	60,835	61,001	61,326 (12,265) [2,944] {1,472}	61,636 (12,327) [2,959] {1,479}	61,908 (12,382) [2,972] {1,486}
Prince George's	69,600	69,779	70,020	70,244	70,646 (14,129) [3,391] {1,695}	71,033 (14,207) [3,410] {1,705}	71,391 (14,278) [3,427] {1,713}

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.