IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/19/21

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 11/19/21 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
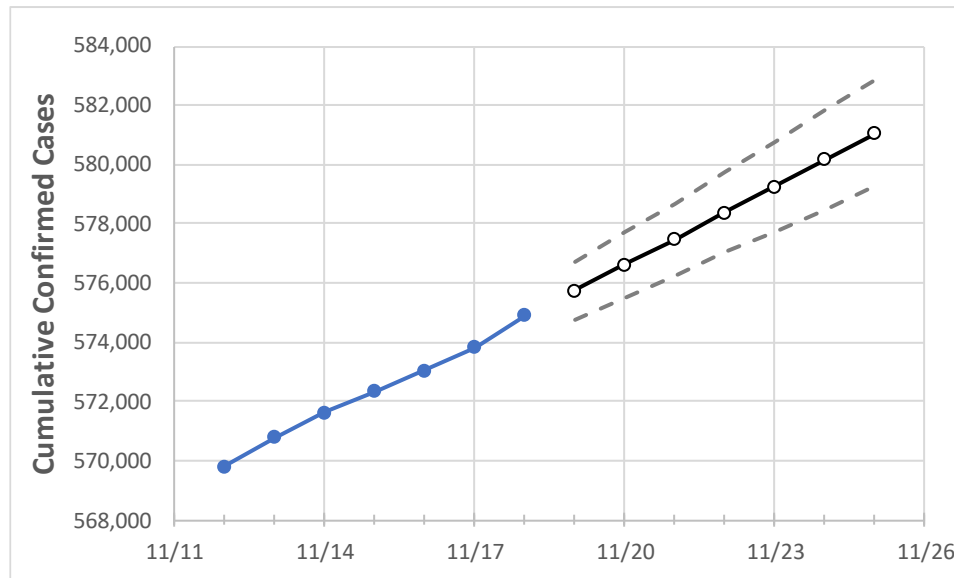
	Actual Confirmed Cases On:				Projected Cases For:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Maryland	572,342	573,044	573,835	574,914	575,759	576,638	577,492	578,380	579,271	580,166	581,070

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Anne Arundel	54,185	54,243	54,326	54,427	54,504	54,582	54,659	54,739	54,818	54,899	54,980
Baltimore City	62,922	62,995	63,023	63,109	63,198	63,293	63,383	63,477	63,573	63,669	63,766
Baltimore County	78,338	78,424	78,579	78,751	78,876	79,001	79,127	79,261	79,393	79,528	79,665
Charles	14,735	14,745	14,760	14,781	14,793	14,805	14,817	14,829	14,841	14,852	14,864
Frederick	25,055	25,112	25,171	25,223	25,277	25,332	25,389	25,446	25,502	25,563	25,622
Harford	21,387	21,421	21,477	21,525	21,569	21,614	21,659	21,705	21,751	21,798	21,846
Howard	23,087	23,140	23,176	23,210	23,247	23,284	23,323	23,362	23,404	23,446	23,487
Montgomery	83,793	83,868	83,981	84,110	84,210	84,313	84,415	84,521	84,628	84,738	84,848
Prince George's	100,959	101,020	101,116	101,218	101,295	101,373	101,453	101,532	101,613	101,696	101,776

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:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Anne Arundel	54,185	54,243	54,326	54,427	54,582 (10,916) [2,620] {1,310}	54,739 (10,948) [2,627] {1,314}	54,899 (10,980) [2,635] {1,318}
Baltimore City	62,922	62,995	63,023	63,109	63,293 (12,659) [3,038] {1,519}	63,477 (12,695) [3,047] {1,523}	63,669 (12,734) [3,056] {1,528}
Baltimore County	78,338	78,424	78,579	78,751	79,001 (15,800) [3,792] {1,896}	79,261 (15,852) [3,805] {1,902}	79,528 (15,906) [3,817] {1,909}
Charles	14,735	14,745	14,760	14,781	14,805 (2,961) [711] {355}	14,829 (2,966) [712] {356}	14,852 (2,970) [713] {356}
Frederick	25,055	25,112	25,171	25,223	25,332 (5,066) [1,216] {608}	25,446 (5,089) [1,221] {611}	25,563 (5,113) [1,227] {614}
Harford	21,387	21,421	21,477	21,525	21,614 (4,323) [1,037] {519}	21,705 (4,341) [1,042] {521}	21,798 (4,360) [1,046] {523}
Howard	23,087	23,140	23,176	23,210	23,284 (4,657) [1,118] {559}	23,362 (4,672) [1,121] {561}	23,446 (4,689) [1,125] {563}
Montgomery	83,793	83,868	83,981	84,110	84,313 (16,863) [4,047] {2,024}	84,521 (16,904) [4,057] {2,029}	84,738 (16,948) [4,067] {2,034}
Prince George's	100,959	101,020	101,116	101,218	101,373 (20,275) [4,866] {2,433}	101,532 (20,306) [4,874] {2,437}	101,696 (20,339) [4,881] {2,441}

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.