IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/24/22

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 1/24/22 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
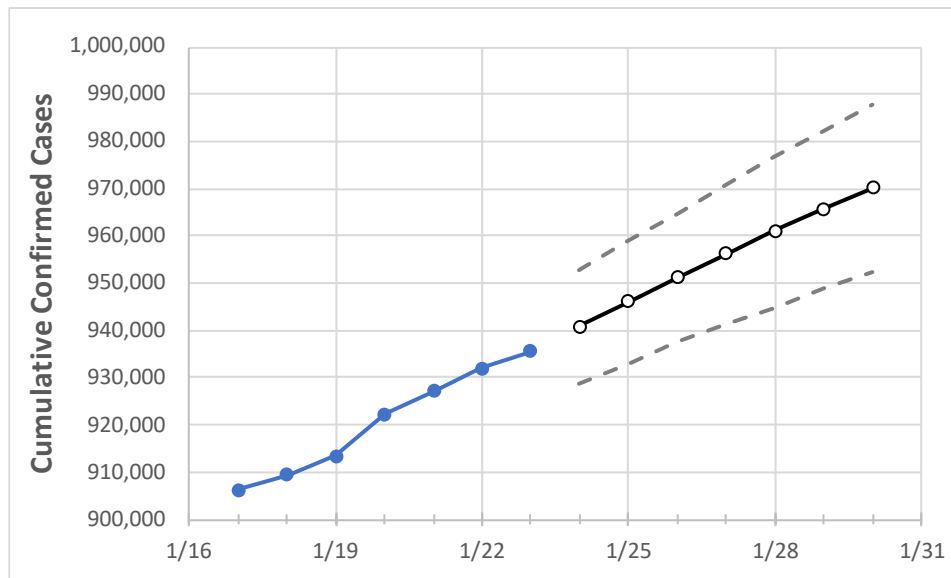
	Actual Confirmed Cases On:				Projected Cases For:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Maryland	922,361	927,097	931,946	935,624	940,935	946,169	951,261	956,315	961,148	965,839	970,245

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Anne Arundel	81,501	81,895	82,278	82,588	83,002	83,413	83,788	84,160	84,511	84,880	85,216
Baltimore City	102,671	103,075	103,482	103,791	104,300	104,791	105,252	105,707	106,163	106,596	106,974
Baltimore County	121,589	122,145	122,606	123,065	123,585	124,091	124,578	125,035	125,481	125,918	126,319
Charles	25,343	25,544	25,623	25,694	25,854	26,015	26,185	26,331	26,482	26,634	26,770
Frederick	41,304	41,524	41,657	41,813	42,054	42,303	42,515	42,730	42,941	43,150	43,353
Harford	34,725	34,866	35,047	35,193	35,383	35,561	35,738	35,899	36,062	36,224	36,373
Howard	39,102	39,312	39,516	39,693	39,947	40,189	40,418	40,643	40,845	41,075	41,275
Montgomery	152,742	153,631	154,148	154,608	155,602	156,538	157,447	158,299	159,127	159,972	160,698
Prince George's	158,871	159,358	159,724	159,983	160,628	161,198	161,742	162,246	162,753	163,276	163,698

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:		
	1/20	1/21	1/22	1/23	1/25	1/27	1/29
Anne Arundel	81,501	81,895	82,278	82,588	83,413 (16,683) [4,004] {2,002}	84,160 (16,832) [4,040] {2,020}	84,880 (16,976) [4,074] {2,037}
Baltimore City	102,671	103,075	103,482	103,791	104,791 (20,958) [5,030] {2,515}	105,707 (21,141) [5,074] {2,537}	106,596 (21,319) [5,117] {2,558}
Baltimore County	121,589	122,145	122,606	123,065	124,091 (24,818) [5,956] {2,978}	125,035 (25,007) [6,002] {3,001}	125,918 (25,184) [6,044] {3,022}
Charles	25,343	25,544	25,623	25,694	26,015 (5,203) [1,249] {624}	26,331 (5,266) [1,264] {632}	26,634 (5,327) [1,278] {639}
Frederick	41,304	41,524	41,657	41,813	42,303 (8,461) [2,031] {1,015}	42,730 (8,546) [2,051] {1,026}	43,150 (8,630) [2,071] {1,036}
Harford	34,725	34,866	35,047	35,193	35,561 (7,112) [1,707] {853}	35,899 (7,180) [1,723] {862}	36,224 (7,245) [1,739] {869}
Howard	39,102	39,312	39,516	39,693	40,189 (8,038) [1,929] {965}	40,643 (8,129) [1,951] {975}	41,075 (8,215) [1,972] {986}
Montgomery	152,742	153,631	154,148	154,608	156,538 (31,308) [7,514] {3,757}	158,299 (31,660) [7,598] {3,799}	159,972 (31,994) [7,679] {3,839}
Prince George's	158,871	159,358	159,724	159,983	161,198 (32,240) [7,738] {3,869}	162,246 (32,449) [7,788] {3,894}	163,276 (32,655) [7,837] {3,919}

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.