IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/29/21

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 not 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 12/29/21 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
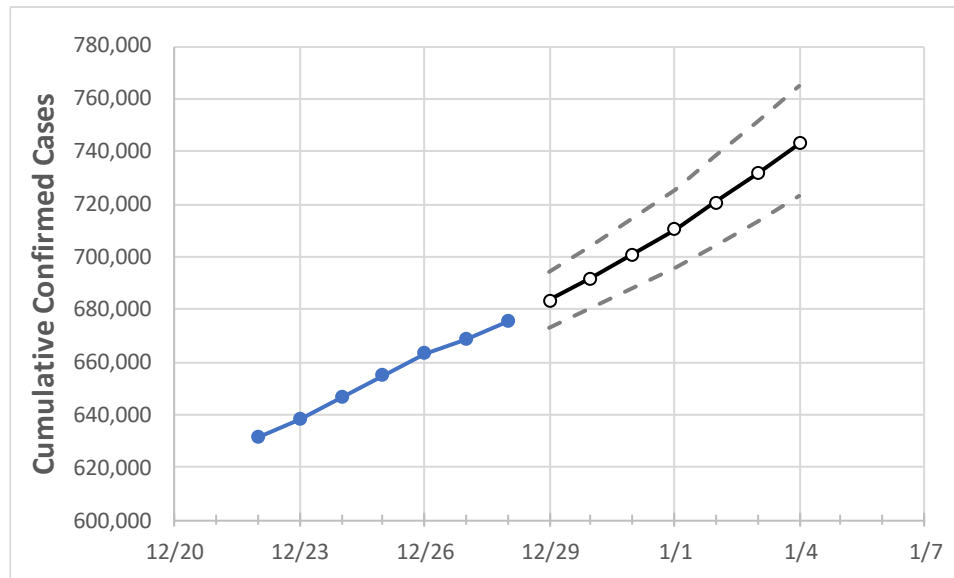
	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Maryland	655,069	663,414	668,790	675,364	683,331	691,730	700,823	710,410	720,684	731,726	743,128

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Anne Arundel	60,689	61,462	61,960	62,569	63,328	64,112	64,966	65,869	66,812	67,847	68,945
Baltimore City	74,239	75,185	75,794	76,539	77,503	78,520	79,619	80,805	82,083	83,424	84,887
Baltimore County	88,662	89,792	90,519	91,409	92,488	93,644	94,888	96,181	97,612	99,073	100,676
Charles	17,571	17,714	17,888	18,070	18,305	18,547	18,809	19,088	19,392	19,713	20,063
Frederick	29,036	29,271	29,559	29,990	30,369	30,772	31,196	31,660	32,130	32,643	33,188
Harford	25,211	25,532	25,739	25,992	26,289	26,600	26,935	27,280	27,650	28,044	28,462
Howard	26,539	26,877	27,095	27,361	27,695	28,040	28,426	28,821	29,242	29,716	30,198
Montgomery	95,847	96,623	97,573	99,624	101,091	102,649	104,347	106,149	108,086	110,211	112,430
Prince George's	117,352	118,303	119,466	121,402	123,143	125,002	127,006	129,181	131,510	134,043	136,714

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:		
	12/25	12/26	12/27	12/28	12/30	1/1	1/3
Anne Arundel	60,689	61,462	61,960	62,569	64,112 (12,822) [3,077] {1,539}	65,869 (13,174) [3,162] {1,581}	67,847 (13,569) [3,257] {1,628}
Baltimore City	74,239	75,185	75,794	76,539	78,520 (15,704) [3,769] {1,884}	80,805 (16,161) [3,879] {1,939}	83,424 (16,685) [4,004] {2,002}
Baltimore County	88,662	89,792	90,519	91,409	93,644 (18,729) [4,495] {2,247}	96,181 (19,236) [4,617] {2,308}	99,073 (19,815) [4,756] {2,378}
Charles	17,571	17,714	17,888	18,070	18,547 (3,709) [890] {445}	19,088 (3,818) [916] {458}	19,713 (3,943) [946] {473}
Frederick	29,036	29,271	29,559	29,990	30,772 (6,154) [1,477] {739}	31,660 (6,332) [1,520] {760}	32,643 (6,529) [1,567] {783}
Harford	25,211	25,532	25,739	25,992	26,600 (5,320) [1,277] {638}	27,280 (5,456) [1,309] {655}	28,044 (5,609) [1,346] {673}
Howard	26,539	26,877	27,095	27,361	28,040 (5,608) [1,346] {673}	28,821 (5,764) [1,383] {692}	29,716 (5,943) [1,426] {713}
Montgomery	95,847	96,623	97,573	99,624	102,649 (20,530) [4,927] {2,464}	106,149 (21,230) [5,095] {2,548}	110,211 (22,042) [5,290] {2,645}
Prince George's	117,352	118,303	119,466	121,402	125,002 (25,000) [6,000] {3,000}	129,181 (25,836) [6,201] {3,100}	134,043 (26,809) [6,434] {3,217}

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.