IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/23/22

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 2/23/22 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
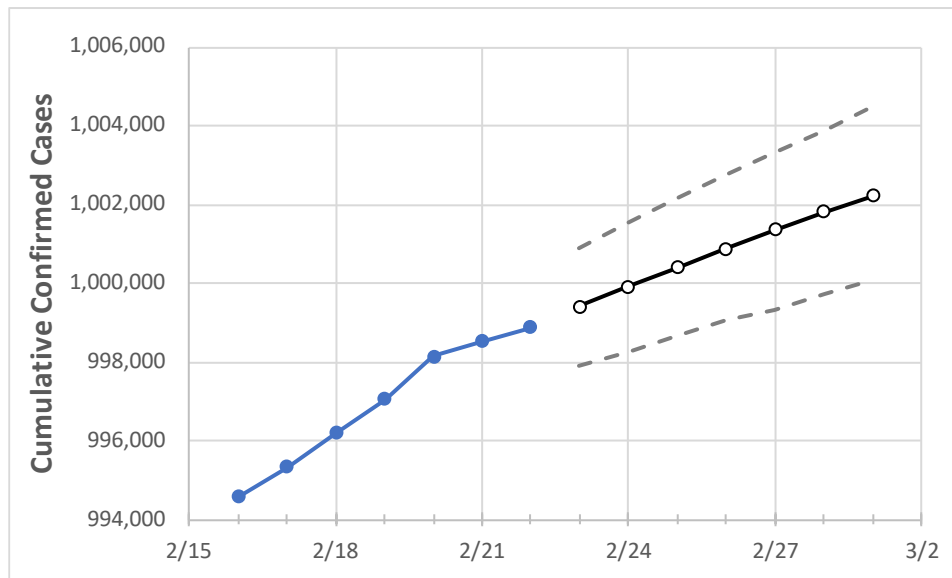
	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Maryland	997,047	998,136	998,512	998,888	999,404	999,913	1,000,403	1,000,878	1,001,364	1,001,815	1,002,213

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Anne Arundel	87,740	87,806	87,842	87,878	88,077	88,234	88,370	88,553	88,730	88,923	89,031
Baltimore City	109,622	110,124	110,156	110,187	110,523	110,902	111,146	111,431	111,725	112,100	112,461
Baltimore County	129,952	130,128	130,170	130,211	130,519	130,840	131,134	131,437	131,786	132,066	132,358
Charles	27,476	27,490	27,503	27,511	27,572	27,621	27,672	27,725	27,767	27,821	27,878
Frederick	44,840	44,857	44,873	44,903	44,999	45,106	45,181	45,267	45,373	45,486	45,558
Harford	37,551	37,575	37,589	37,602	37,686	37,765	37,837	37,918	37,989	38,064	38,130
Howard	42,679	42,720	42,744	42,768	42,864	42,946	43,032	43,106	43,197	43,275	43,361
Montgomery	164,455	164,529	164,603	164,655	165,053	165,386	165,730	166,086	166,343	166,729	167,069
Prince George's	168,378	168,416	168,453	168,491	168,950	169,331	169,643	170,001	170,240	170,813	171,188

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Anne Arundel	87,740	87,806	87,842	87,878	88,234 (17,647) [4,235] {2,118}	88,553 (17,711) [4,251] {2,125}	88,923 (17,785) [4,268] {2,134}
Baltimore City	109,622	110,124	110,156	110,187	110,902 (22,180) [5,323] {2,662}	111,431 (22,286) [5,349] {2,674}	112,100 (22,420) [5,381] {2,690}
Baltimore County	129,952	130,128	130,170	130,211	130,840 (26,168) [6,280] {3,140}	131,437 (26,287) [6,309] {3,154}	132,066 (26,413) [6,339] {3,170}
Charles	27,476	27,490	27,503	27,511	27,621 (5,524) [1,326] {663}	27,725 (5,545) [1,331] {665}	27,821 (5,564) [1,335] {668}
Frederick	44,840	44,857	44,873	44,903	45,106 (9,021) [2,165] {1,083}	45,267 (9,053) [2,173] {1,086}	45,486 (9,097) [2,183] {1,092}
Harford	37,551	37,575	37,589	37,602	37,765 (7,553) [1,813] {906}	37,918 (7,584) [1,820] {910}	38,064 (7,613) [1,827] {914}
Howard	42,679	42,720	42,744	42,768	42,946 (8,589) [2,061] {1,031}	43,106 (8,621) [2,069] {1,035}	43,275 (8,655) [2,077] {1,039}
Montgomery	164,455	164,529	164,603	164,655	165,386 (33,077) [7,939] {3,969}	166,086 (33,217) [7,972] {3,986}	166,729 (33,346) [8,003] {4,001}
Prince George's	168,378	168,416	168,453	168,491	169,331 (33,866) [8,128] {4,064}	170,001 (34,000) [8,160] {4,080}	170,813 (34,163) [8,199] {4,100}

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.