IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/4/21

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 10/4/21 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
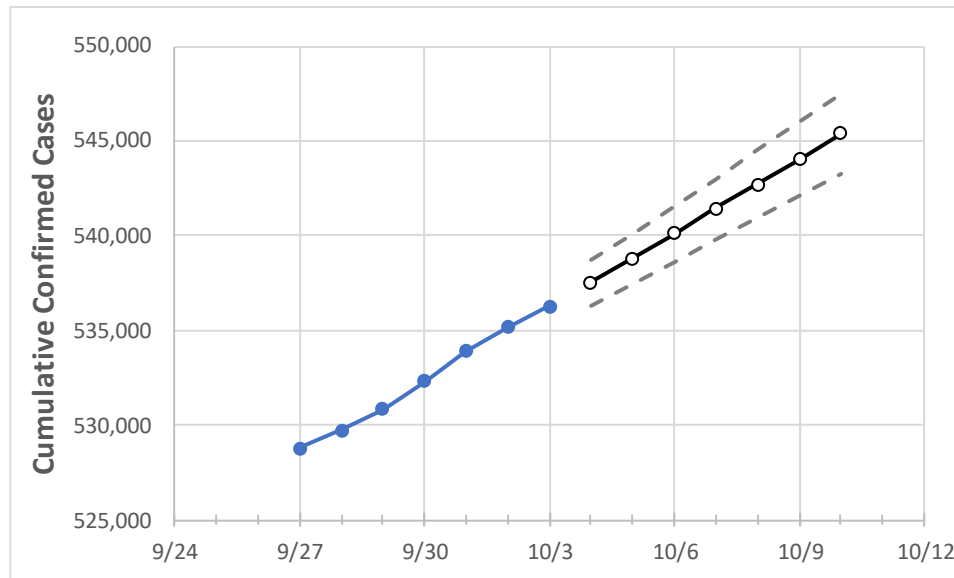
	Actual Confirmed Cases On:				Projected Cases For:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Maryland	532,340	533,870	535,157	536,249	537,530	538,818	540,099	541,416	542,724	544,050	545,393

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:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Anne Arundel	50,469	50,582	50,722	50,846	50,962	51,077	51,192	51,309	51,427	51,546	51,663
Baltimore City	59,003	59,168	59,246	59,432	59,564	59,699	59,833	59,975	60,110	60,259	60,401
Baltimore County	73,574	73,745	73,936	74,056	74,207	74,358	74,511	74,666	74,823	74,987	75,144
Charles	13,786	13,826	13,862	13,884	13,922	13,958	13,994	14,032	14,069	14,105	14,142
Frederick	23,089	23,138	23,176	23,229	23,278	23,328	23,377	23,427	23,477	23,527	23,578
Harford	19,358	19,413	19,464	19,500	19,547	19,596	19,644	19,693	19,741	19,790	19,839
Howard	21,883	21,934	21,956	21,986	22,025	22,065	22,104	22,143	22,182	22,222	22,262
Montgomery	79,948	80,069	80,175	80,272	80,389	80,505	80,621	80,735	80,851	80,964	81,081
Prince George's	96,880	96,984	97,101	97,202	97,342	97,485	97,624	97,759	97,898	98,036	98,174

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:		
	9/30	10/1	10/2	10/3	10/5	10/7	10/9
Anne Arundel	50,469	50,582	50,722	50,846	51,077 (10,215) [2,452] {1,226}	51,309 (10,262) [2,463] {1,231}	51,546 (10,309) [2,474] {1,237}
Baltimore City	59,003	59,168	59,246	59,432	59,699 (11,940) [2,866] {1,433}	59,975 (11,995) [2,879] {1,439}	60,259 (12,052) [2,892] {1,446}
Baltimore County	73,574	73,745	73,936	74,056	74,358 (14,872) [3,569] {1,785}	74,666 (14,933) [3,584] {1,792}	74,987 (14,997) [3,599] {1,800}
Charles	13,786	13,826	13,862	13,884	13,958 (2,792) [670] {335}	14,032 (2,806) [674] {337}	14,105 (2,821) [677] {339}
Frederick	23,089	23,138	23,176	23,229	23,328 (4,666) [1,120] {560}	23,427 (4,685) [1,124] {562}	23,527 (4,705) [1,129] {565}
Harford	19,358	19,413	19,464	19,500	19,596 (3,919) [941] {470}	19,693 (3,939) [945] {473}	19,790 (3,958) [950] {475}
Howard	21,883	21,934	21,956	21,986	22,065 (4,413) [1,059] {530}	22,143 (4,429) [1,063] {531}	22,222 (4,444) [1,067] {533}
Montgomery	79,948	80,069	80,175	80,272	80,505 (16,101) [3,864] {1,932}	80,735 (16,147) [3,875] {1,938}	80,964 (16,193) [3,886] {1,943}
Prince George's	96,880	96,984	97,101	97,202	97,485 (19,497) [4,679] {2,340}	97,759 (19,552) [4,692] {2,346}	98,036 (19,607) [4,706] {2,353}

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.