IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/20/21

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 4/20/21 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.
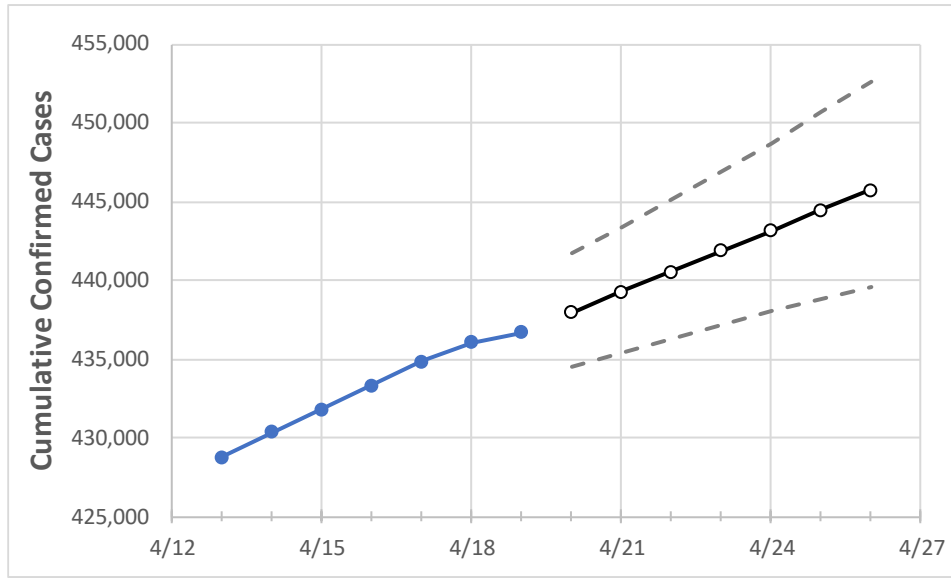
IEM's Modeling Lead

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Maryland	433,359	434,859	436,028	436,659	437,982	439,271	440,555	441,875	443,171	444,468	445,742

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Anne Arundel	41,045	41,221	41,312	41,386	41,521	41,656	41,789	41,925	42,063	42,197	42,337
Baltimore City	48,579	48,885	49,104	49,255	49,505	49,764	50,015	50,270	50,525	50,780	51,036
Baltimore County	60,389	60,716	60,935	61,095	61,388	61,674	61,966	62,264	62,563	62,856	63,154
Charles	10,241	10,269	10,284	10,296	10,319	10,342	10,365	10,388	10,410	10,432	10,454
Frederick	19,039	19,088	19,111	19,150	19,196	19,242	19,288	19,334	19,380	19,425	19,471
Harford	15,395	15,480	15,552	15,581	15,650	15,719	15,788	15,858	15,926	15,993	16,059
Howard	18,249	18,342	18,385	18,406	18,459	18,514	18,567	18,623	18,678	18,733	18,789
Montgomery	68,718	68,842	68,865	68,945	69,042	69,137	69,229	69,320	69,411	69,500	69,586
Prince George's	81,190	81,342	81,382	81,523	81,683	81,849	82,010	82,169	82,326	82,480	82,637

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:		
	4/16	4/17	4/18	4/19	4/21	4/23	4/25
Anne Arundel	41,045	41,221	41,312	41,386	41,656 (8,331) [1,999] {1,000}	41,925 (8,385) [2,012] {1,006}	42,197 (8,439) [2,025] {1,013}
Baltimore City	48,579	48,885	49,104	49,255	49,764 (9,953) [2,389] {1,194}	50,270 (10,054) [2,413] {1,206}	50,780 (10,156) [2,437] {1,219}
Baltimore County	60,389	60,716	60,935	61,095	61,674 (12,335) [2,960] {1,480}	62,264 (12,453) [2,989] {1,494}	62,856 (12,571) [3,017] {1,509}
Charles	10,241	10,269	10,284	10,296	10,342 (2,068) [496] {248}	10,388 (2,078) [499] {249}	10,432 (2,086) [501] {250}
Frederick	19,039	19,088	19,111	19,150	19,242 (3,848) [924] {462}	19,334 (3,867) [928] {464}	19,425 (3,885) [932] {466}
Harford	15,395	15,480	15,552	15,581	15,719 (3,144) [755] {377}	15,858 (3,172) [761] {381}	15,993 (3,199) [768] {384}
Howard	18,249	18,342	18,385	18,406	18,514 (3,703) [889] {444}	18,623 (3,725) [894] {447}	18,733 (3,747) [899] {450}
Montgomery	68,718	68,842	68,865	68,945	69,137 (13,827) [3,319] {1,659}	69,320 (13,864) [3,327] {1,664}	69,500 (13,900) [3,336] {1,668}
Prince George's	81,190	81,342	81,382	81,523	81,849 (16,370) [3,929] {1,964}	82,169 (16,434) [3,944] {1,972}	82,480 (16,496) [3,959] {1,980}

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.