IEM's AI Modeling: Short-term COVID-19 Projections

Date: 12/8/21

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 12/8/21 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.

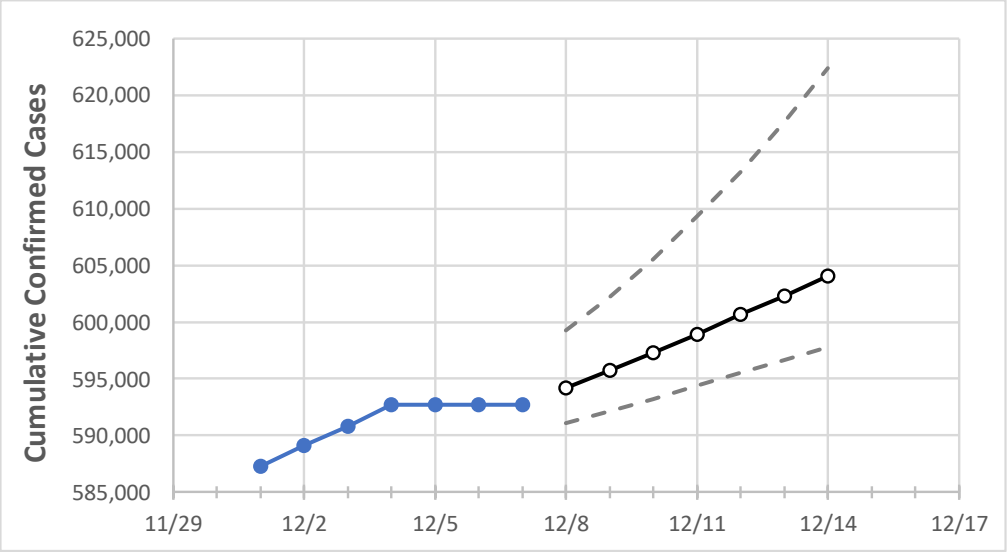
IEM's Modeling Lead

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Maryland	592,679	592,679	592,679	592,679	594,192	595,757	597,286	598,931	600,648	602,297	604,019

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Anne Arundel	56,103	56,103	56,103	56,103	56,233	56,367	56,506	56,642	56,785	56,933	57,084
Baltimore City	64,970	64,970	64,970	64,970	65,106	65,237	65,378	65,520	65,666	65,814	65,961
Baltimore County	81,122	81,122	81,122	81,122	81,325	81,529	81,742	81,955	82,182	82,407	82,645
Charles	15,068	15,068	15,068	15,068	15,094	15,121	15,148	15,176	15,206	15,236	15,267
Frederick	26,247	26,247	26,247	26,247	26,338	26,434	26,530	26,628	26,733	26,840	26,946
Harford	22,674	22,674	22,674	22,674	22,789	22,910	23,031	23,162	23,296	23,436	23,577
Howard	23,804	23,804	23,804	23,804	23,843	23,880	23,919	23,957	23,997	24,036	24,078
Montgomery	86,011	86,011	86,011	86,011	86,183	86,360	86,541	86,726	86,922	87,121	87,318
Prince George's	102,652	102,652	102,652	102,652	102,778	102,908	103,039	103,178	103,316	103,462	103,609

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:		
	12/4	12/5	12/6	12/7	12/9	12/11	12/13
Anne Arundel	56,103	56,103	56,103	56,103	56,367 (11,273) [2,706] {1,353}	56,642 (11,328) [2,719] {1,359}	56,933 (11,387) [2,733] {1,366}
Baltimore City	64,970	64,970	64,970	64,970	65,237 (13,047) [3,131] {1,566}	65,520 (13,104) [3,145] {1,572}	65,814 (13,163) [3,159] {1,580}
Baltimore County	81,122	81,122	81,122	81,122	81,529 (16,306) [3,913] {1,957}	81,955 (16,391) [3,934] {1,967}	82,407 (16,481) [3,956] {1,978}
Charles	15,068	15,068	15,068	15,068	15,121 (3,024) [726] {363}	15,176 (3,035) [728] {364}	15,236 (3,047) [731] {366}
Frederick	26,247	26,247	26,247	26,247	26,434 (5,287) [1,269] {634}	26,628 (5,326) [1,278] {639}	26,840 (5,368) [1,288] {644}
Harford	22,674	22,674	22,674	22,674	22,910 (4,582) [1,100] {550}	23,162 (4,632) [1,112] {556}	23,436 (4,687) [1,125] {562}
Howard	23,804	23,804	23,804	23,804	23,880 (4,776) [1,146] {573}	23,957 (4,791) [1,150] {575}	24,036 (4,807) [1,154] {577}
Montgomery	86,011	86,011	86,011	86,011	86,360 (17,272) [4,145] {2,073}	86,726 (17,345) [4,163] {2,081}	87,121 (17,424) [4,182] {2,091}
Prince George's	102,652	102,652	102,652	102,652	102,908 (20,582) [4,940] {2,470}	103,178 (20,636) [4,953] {2,476}	103,462 (20,692) [4,966] {2,483}

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.