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

Date: 4/2/21

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 4/2/21 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.

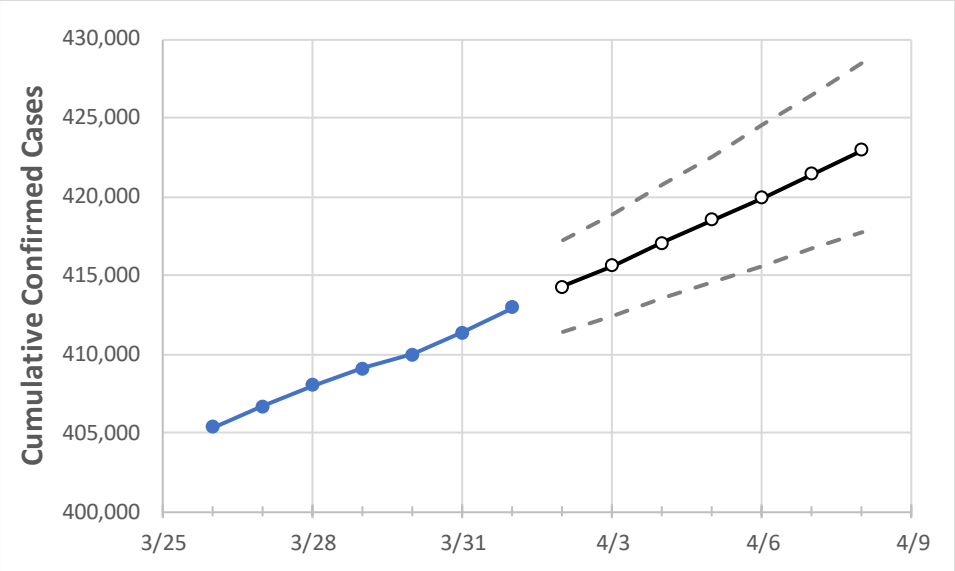
IEM's Modeling Lead

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Maryland	409,075	409,978	411,344	412,928	414,259	415,632	417,052	418,498	419,946	421,443	422,931

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Anne Arundel	38,671	38,776	38,894	39,062	39,201	39,343	39,486	39,631	39,779	39,927	40,080
Baltimore City	44,237	44,390	44,629	44,869	45,113	45,362	45,619	45,892	46,171	46,464	46,762
Baltimore County	55,451	55,611	55,856	56,179	56,441	56,710	56,992	57,284	57,584	57,889	58,205
Charles	9,695	9,724	9,764	9,803	9,834	9,866	9,898	9,932	9,966	9,999	10,033
Frederick	18,133	18,183	18,252	18,286	18,338	18,389	18,442	18,496	18,549	18,604	18,659
Harford	13,898	13,944	14,053	14,145	14,234	14,328	14,423	14,521	14,620	14,726	14,836
Howard	17,148	17,212	17,270	17,342	17,405	17,469	17,534	17,600	17,670	17,741	17,815
Montgomery	66,589	66,704	66,831	66,951	67,076	67,203	67,331	67,461	67,593	67,724	67,855
Prince George's	77,820	78,011	78,242	78,442	78,631	78,827	79,023	79,222	79,427	79,632	79,842

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Anne Arundel	38,671	38,776	38,894	39,062	39,343 (7,869) [1,888] {944}	39,631 (7,926) [1,902] {951}	39,927 (7,985) [1,916] {958}
Baltimore City	44,237	44,390	44,629	44,869	45,362 (9,072) [2,177] {1,089}	45,892 (9,178) [2,203] {1,101}	46,464 (9,293) [2,230] {1,115}
Baltimore County	55,451	55,611	55,856	56,179	56,710 (11,342) [2,722] {1,361}	57,284 (11,457) [2,750] {1,375}	57,889 (11,578) [2,779] {1,389}
Charles	9,695	9,724	9,764	9,803	9,866 (1,973) [474] {237}	9,932 (1,986) [477] {238}	9,999 (2,000) [480] {240}
Frederick	18,133	18,183	18,252	18,286	18,389 (3,678) [883] {441}	18,496 (3,699) [888] {444}	18,604 (3,721) [893] {446}
Harford	13,898	13,944	14,053	14,145	14,328 (2,866) [688] {344}	14,521 (2,904) [697] {349}	14,726 (2,945) [707] {353}
Howard	17,148	17,212	17,270	17,342	17,469 (3,494) [839] {419}	17,600 (3,520) [845] {422}	17,741 (3,548) [852] {426}
Montgomery	66,589	66,704	66,831	66,951	67,203 (13,441) [3,226] {1,613}	67,461 (13,492) [3,238] {1,619}	67,724 (13,545) [3,251] {1,625}
Prince George's	77,820	78,011	78,242	78,442	78,827 (15,765) [3,784] {1,892}	79,222 (15,844) [3,803] {1,901}	79,632 (15,926) [3,822] {1,911}

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.