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

Date: 1/27/21

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 1/27/21 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.

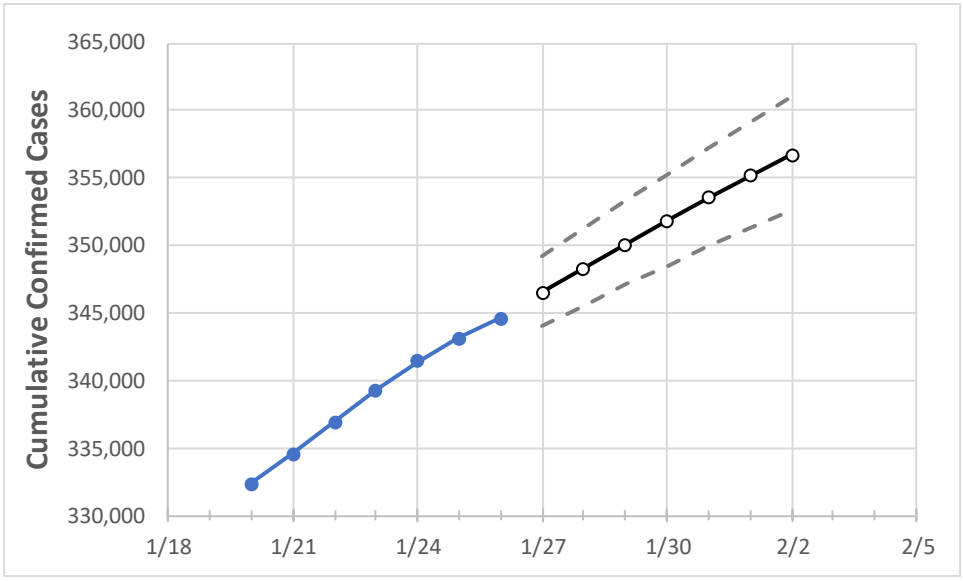
IEM's Modeling Lead

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:						
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
Maryland	339,307	341,452	343,138	344,620	346,506	348,318	350,094	351,837	353,499	355,151	356,732

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:						
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
Anne Arundel	31,396	31,599	31,764	31,909	32,129	32,343	32,555	32,759	32,960	33,154	33,357
Baltimore City	36,688	36,886	37,023	37,087	37,262	37,435	37,602	37,773	37,935	38,098	38,259
Baltimore County	45,459	45,671	45,847	46,027	46,254	46,473	46,690	46,904	47,121	47,337	47,538
Charles	7,551	7,667	7,719	7,786	7,854	7,922	7,989	8,058	8,126	8,196	8,267
Frederick	14,925	15,113	15,216	15,239	15,342	15,444	15,544	15,643	15,736	15,827	15,922
Harford	10,736	10,821	10,896	10,957	11,039	11,122	11,203	11,285	11,363	11,442	11,524
Howard	13,954	14,028	14,077	14,138	14,220	14,301	14,379	14,456	14,530	14,604	14,677
Montgomery	56,328	57,129	57,326	57,685	58,054	58,417	58,781	59,135	59,484	59,828	60,174
Prince George's	65,151	65,865	66,159	66,535	66,924	67,310	67,697	68,085	68,476	68,856	69,227

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:		
	1/23	1/24	1/25	1/26	1/28	1/30	2/1
Anne Arundel	31,396	31,599	31,764	31,909	32,343 (6,469) [1,552] {776}	32,759 (6,552) [1,572] {786}	33,154 (6,631) [1,591] {796}
Baltimore City	36,688	36,886	37,023	37,087	37,435 (7,487) [1,797] {898}	37,773 (7,555) [1,813] {907}	38,098 (7,620) [1,829] {914}
Baltimore County	45,459	45,671	45,847	46,027	46,473 (9,295) [2,231] {1,115}	46,904 (9,381) [2,251] {1,126}	47,337 (9,467) [2,272] {1,136}
Charles	7,551	7,667	7,719	7,786	7,922 (1,584) [380] {190}	8,058 (1,612) [387] {193}	8,196 (1,639) [393] {197}
Frederick	14,925	15,113	15,216	15,239	15,444 (3,089) [741] {371}	15,643 (3,129) [751] {375}	15,827 (3,165) [760] {380}
Harford	10,736	10,821	10,896	10,957	11,122 (2,224) [534] {267}	11,285 (2,257) [542] {271}	11,442 (2,288) [549] {275}
Howard	13,954	14,028	14,077	14,138	14,301 (2,860) [686] {343}	14,456 (2,891) [694] {347}	14,604 (2,921) [701] {351}
Montgomery	56,328	57,129	57,326	57,685	58,417 (11,683) [2,804] {1,402}	59,135 (11,827) [2,838] {1,419}	59,828 (11,966) [2,872] {1,436}
Prince George's	65,151	65,865	66,159	66,535	67,310 (13,462) [3,231] {1,615}	68,085 (13,617) [3,268] {1,634}	68,856 (13,771) [3,305] {1,653}

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.