IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/28/20

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 12/28/20 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
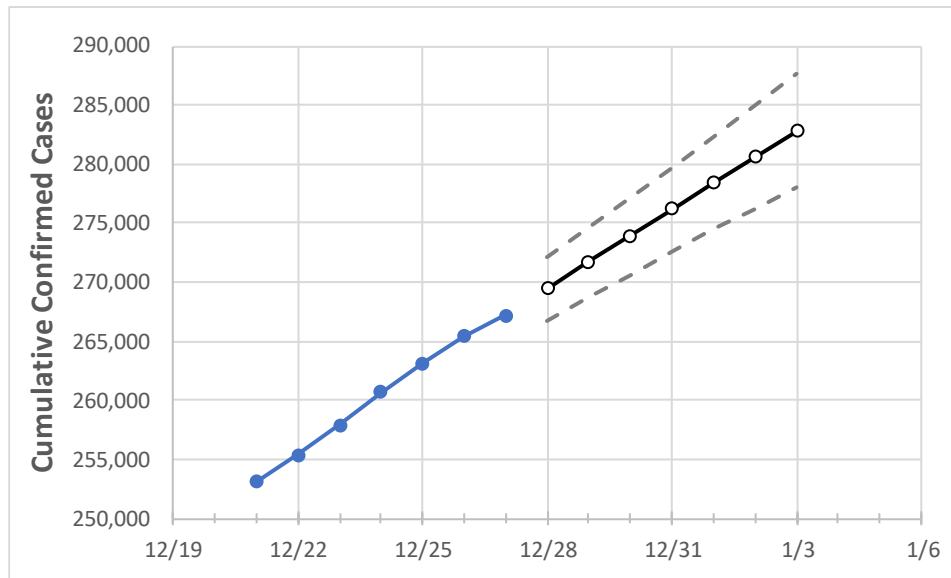
	Actual Confirmed Cases On:				Projected Cases For:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Maryland	260,728	263,160	265,440	267,198	269,439	271,726	273,943	276,188	278,406	280,593	282,796

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 20%, and are often within 10%, of actual confirmed cases.

Maryland Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Anne Arundel	22,710	22,981	23,253	23,408	23,654	23,908	24,157	24,406	24,657	24,908	25,164
Baltimore City	30,290	30,440	30,612	30,777	30,952	31,126	31,300	31,469	31,639	31,803	31,967
Baltimore County	36,897	37,098	37,356	37,549	37,780	38,006	38,232	38,456	38,672	38,885	39,099
Charles	5,763	5,809	5,853	5,892	5,941	5,990	6,038	6,087	6,136	6,183	6,229
Frederick	10,432	10,575	10,670	10,788	10,938	11,086	11,233	11,382	11,530	11,677	11,827
Harford	8,060	8,112	8,194	8,253	8,325	8,396	8,466	8,535	8,604	8,671	8,739
Howard	10,604	10,719	10,769	10,822	10,900	10,978	11,053	11,131	11,208	11,282	11,355
Montgomery	43,871	44,287	44,640	45,050	45,443	45,838	46,225	46,625	47,019	47,413	47,805
Prince George's	52,040	52,767	53,043	53,338	53,715	54,092	54,468	54,834	55,202	55,573	55,950

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:		
	12/24	12/25	12/26	12/27	12/29	12/31	1/2
Anne Arundel	22,710	22,981	23,253	23,408	23,908 (4,782) [1,148] {574}	24,406 (4,881) [1,171] {586}	24,908 (4,982) [1,196] {598}
Baltimore City	30,290	30,440	30,612	30,777	31,126 (6,225) [1,494] {747}	31,469 (6,294) [1,511] {755}	31,803 (6,361) [1,527] {763}
Baltimore County	36,897	37,098	37,356	37,549	38,006 (7,601) [1,824] {912}	38,456 (7,691) [1,846] {923}	38,885 (7,777) [1,867] {933}
Charles	5,763	5,809	5,853	5,892	5,990 (1,198) [287] {144}	6,087 (1,217) [292] {146}	6,183 (1,237) [297] {148}
Frederick	10,432	10,575	10,670	10,788	11,086 (2,217) [532] {266}	11,382 (2,276) [546] {273}	11,677 (2,335) [561] {280}
Harford	8,060	8,112	8,194	8,253	8,396 (1,679) [403] {202}	8,535 (1,707) [410] {205}	8,671 (1,734) [416] {208}
Howard	10,604	10,719	10,769	10,822	10,978 (2,196) [527] {263}	11,131 (2,226) [534] {267}	11,282 (2,256) [542] {271}
Montgomery	43,871	44,287	44,640	45,050	45,838 (9,168) [2,200] {1,100}	46,625 (9,325) [2,238] {1,119}	47,413 (9,483) [2,276] {1,138}
Prince George's	52,040	52,767	53,043	53,338	54,092 (10,818) [2,596] {1,298}	54,834 (10,967) [2,632] {1,316}	55,573 (11,115) [2,667] {1,334}

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.