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

Date: 11/24/21

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 11/24/21 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.

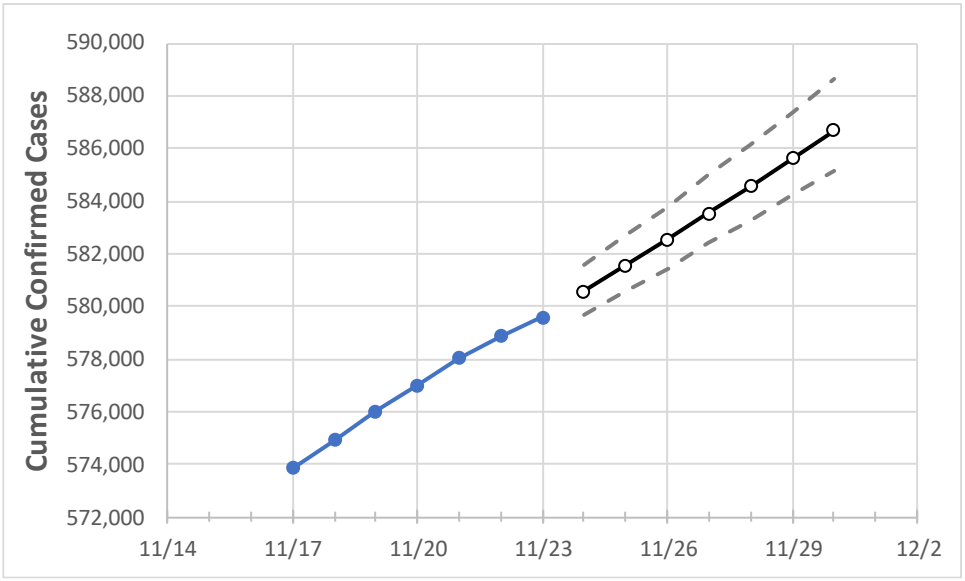
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Maryland	577,013	578,019	578,851	579,591	580,580	581,549	582,531	583,551	584,575	585,615	586,681

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Anne Arundel	54,641	54,751	54,813	54,875	54,970	55,066	55,161	55,264	55,363	55,467	55,576
Baltimore City	63,371	63,506	63,606	63,675	63,788	63,904	64,020	64,136	64,262	64,388	64,517
Baltimore County	79,002	79,128	79,242	79,329	79,462	79,600	79,735	79,878	80,023	80,167	80,317
Charles	14,818	14,840	14,852	14,872	14,887	14,903	14,917	14,934	14,949	14,966	14,982
Frederick	25,321	25,381	25,442	25,507	25,565	25,624	25,683	25,744	25,805	25,868	25,929
Harford	21,638	21,691	21,738	21,772	21,823	21,876	21,928	21,982	22,035	22,092	22,148
Howard	23,289	23,348	23,383	23,417	23,463	23,510	23,558	23,607	23,659	23,713	23,767
Montgomery	84,350	84,443	84,551	84,627	84,739	84,850	84,964	85,083	85,202	85,322	85,448
Prince George's	101,389	101,468	101,532	101,605	101,687	101,768	101,851	101,937	102,021	102,107	102,192

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:											
	11/20	11/21	11/22	11/23	11/25				11/27				11/29			
Anne Arundel	54,641	54,751	54,813	54,875	55,066	(11,013)	[2,643]	{1,322}	55,264	(11,053)	[2,653]	{1,326}	55,467	(11,093)	[2,662]	{1,331}
Baltimore City	63,371	63,506	63,606	63,675	63,904	(12,781)	[3,067]	{1,534}	64,136	(12,827)	[3,079]	{1,539}	64,388	(12,878)	[3,091]	{1,545}
Baltimore County	79,002	79,128	79,242	79,329	79,600	(15,920)	[3,821]	{1,910}	79,878	(15,976)	[3,834]	{1,917}	80,167	(16,033)	[3,848]	{1,924}
Charles	14,818	14,840	14,852	14,872	14,903	(2,981)	[715]	{358}	14,934	(2,987)	[717]	{358}	14,966	(2,993)	[718]	{359}
Frederick	25,321	25,381	25,442	25,507	25,624	(5,125)	[1,230]	{615}	25,744	(5,149)	[1,236]	{618}	25,868	(5,174)	[1,242]	{621}
Harford	21,638	21,691	21,738	21,772	21,876	(4,375)	[1,050]	{525}	21,982	(4,396)	[1,055]	{528}	22,092	(4,418)	[1,060]	{530}
Howard	23,289	23,348	23,383	23,417	23,510	(4,702)	[1,128]	{564}	23,607	(4,721)	[1,133]	{567}	23,713	(4,743)	[1,138]	{569}
Montgomery	84,350	84,443	84,551	84,627	84,850	(16,970)	[4,073]	{2,036}	85,083	(17,017)	[4,084]	{2,042}	85,322	(17,064)	[4,095]	{2,048}
Prince George's	101,389	101,468	101,532	101,605	101,768	(20,354)	[4,885]	{2,442}	101,937	(20,387)	[4,893]	{2,446}	102,107	(20,421)	[4,901]	{2,451}

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.