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

Date: 1/28/22

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 1/28/22 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.

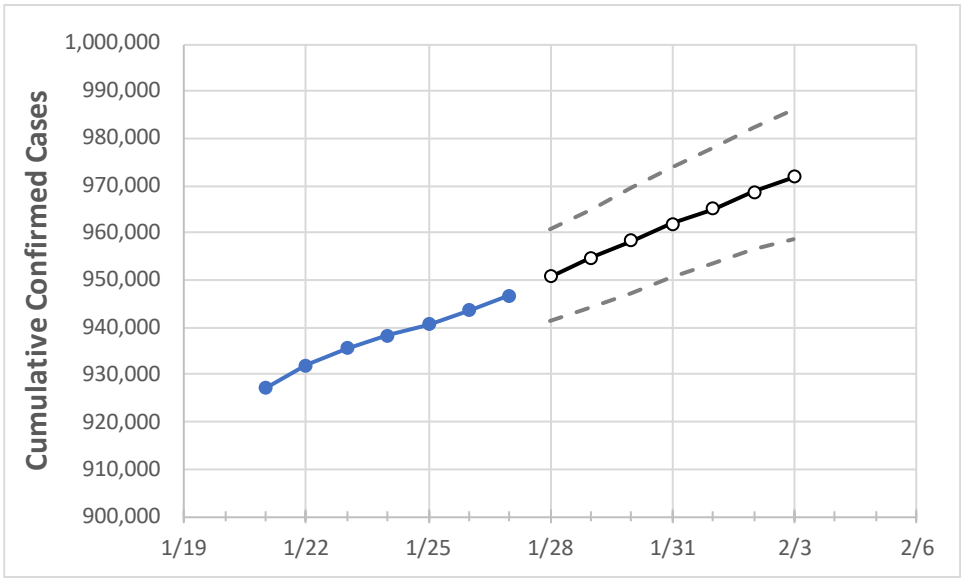
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Maryland	938,314	940,713	943,613	946,869	950,860	954,699	958,344	962,016	965,207	968,688	971,921

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Anne Arundel	82,801	83,026	83,320	83,673	83,998	84,307	84,616	84,902	85,193	85,458	85,724
Baltimore City	103,988	104,123	104,294	104,531	104,891	105,234	105,554	105,875	106,177	106,473	106,752
Baltimore County	123,339	123,562	123,755	124,032	124,403	124,753	125,080	125,406	125,718	126,025	126,297
Charles	25,796	25,883	25,980	26,076	26,206	26,326	26,441	26,551	26,662	26,769	26,869
Frederick	41,985	42,141	42,297	42,423	42,590	42,752	42,897	43,045	43,179	43,312	43,444
Harford	35,337	35,409	35,519	35,646	35,780	35,906	36,020	36,138	36,250	36,357	36,453
Howard	39,795	39,934	40,082	40,205	40,384	40,555	40,717	40,884	41,046	41,196	41,341
Montgomery	155,003	155,675	156,147	156,593	157,304	157,979	158,595	159,218	159,830	160,391	160,900
Prince George's	160,241	160,594	160,975	161,293	161,712	162,126	162,540	162,899	163,270	163,597	163,906

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Anne Arundel	82,801	83,026	83,320	83,673	84,307	(16,861)	[4,047]	{2,023}	84,902	(16,980)	[4,075]	{2,038}	85,458	(17,092)	[4,102]	{2,051}
Baltimore City	103,988	104,123	104,294	104,531	105,234	(21,047)	[5,051]	{2,526}	105,875	(21,175)	[5,082]	{2,541}	106,473	(21,295)	[5,111]	{2,555}
Baltimore County	123,339	123,562	123,755	124,032	124,753	(24,951)	[5,988]	{2,994}	125,406	(25,081)	[6,019]	{3,010}	126,025	(25,205)	[6,049]	{3,025}
Charles	25,796	25,883	25,980	26,076	26,326	(5,265)	[1,264]	{632}	26,551	(5,310)	[1,274]	{637}	26,769	(5,354)	[1,285]	{642}
Frederick	41,985	42,141	42,297	42,423	42,752	(8,550)	[2,052]	{1,026}	43,045	(8,609)	[2,066]	{1,033}	43,312	(8,662)	[2,079]	{1,039}
Harford	35,337	35,409	35,519	35,646	35,906	(7,181)	[1,723]	{862}	36,138	(7,228)	[1,735]	{867}	36,357	(7,271)	[1,745]	{873}
Howard	39,795	39,934	40,082	40,205	40,555	(8,111)	[1,947]	{973}	40,884	(8,177)	[1,962]	{981}	41,196	(8,239)	[1,977]	{989}
Montgomery	155,003	155,675	156,147	156,593	157,979	(31,596)	[7,583]	{3,791}	159,218	(31,844)	[7,642]	{3,821}	160,391	(32,078)	[7,699]	{3,849}
Prince George's	160,241	160,594	160,975	161,293	162,126	(32,425)	[7,782]	{3,891}	162,899	(32,580)	[7,819]	{3,910}	163,597	(32,719)	[7,853]	{3,926}

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.