

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

Date: 7/1/21

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 7/1/21 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.

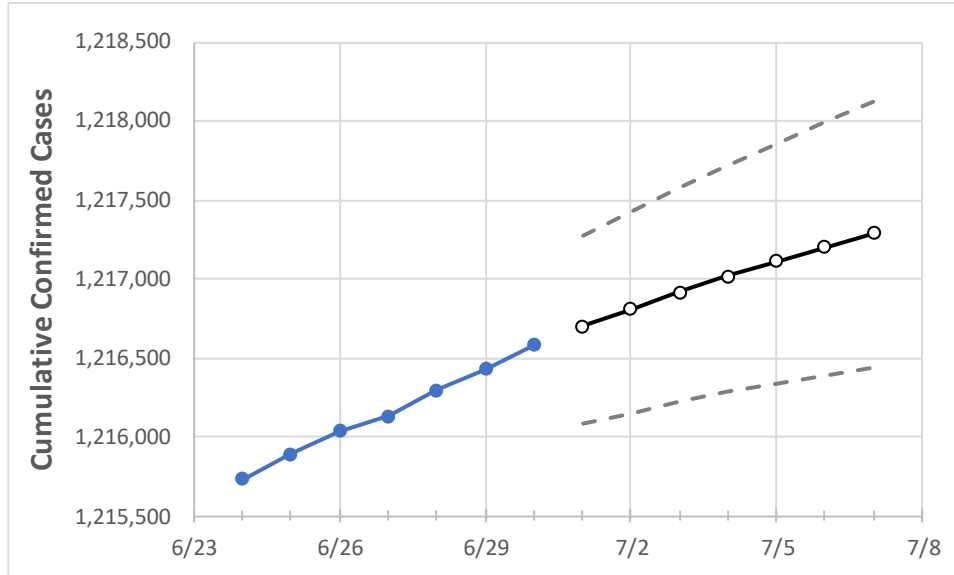
IEM's Modeling Lead

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.

Pennsylvania State Projections



Actual Confirmed Cases On:				Projected Cases For:							
6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	

Pennsylvania 1,216,133 1,216,293 1,216,430 1,216,579 1,216,698 1,216,807 1,216,915 1,217,015 1,217,114 1,217,203 1,217,290

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.

Pennsylvania Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	
Allegheny	101,864	101,871	101,886	101,898	101,907	101,917	101,926	101,935	101,943	101,951	101,959	
Berks	48,449	48,450	48,459	48,467	48,472	48,477	48,481	48,485	48,489	48,493	48,496	
Bucks	60,804	60,805	60,809	60,816	60,819	60,822	60,824	60,827	60,829	60,831	60,833	
Butler	17,614	17,617	17,621	17,623	17,625	17,627	17,629	17,630	17,632	17,633	17,635	
Chester	40,816	40,822	40,827	40,827	40,833	40,839	40,845	40,851	40,857	40,863	40,869	
Delaware	52,379	52,389	52,386	52,383	52,388	52,392	52,397	52,401	52,404	52,408	52,412	
Lackawanna	18,556	18,558	18,560	18,561	18,563	18,566	18,568	18,570	18,572	18,574	18,576	
Lancaster	55,402	55,409	55,415	55,423	55,427	55,431	55,435	55,439	55,443	55,446	55,449	
Lehigh	39,842	39,840	39,841	39,845	39,848	39,850	39,853	39,855	39,857	39,859	39,861	
Luzerne	32,101	32,105	32,107	32,118	32,122	32,127	32,131	32,135	32,138	32,142	32,145	
Monroe	14,821	14,823	14,825	14,827	14,829	14,831	14,833	14,835	14,837	14,838	14,840	
Montgomery	70,390	70,396	70,400	70,410	70,414	70,418	70,422	70,426	70,429	70,432	70,435	
Northampton	35,877	35,879	35,885	35,886	35,889	35,892	35,895	35,898	35,901	35,904	35,906	
Philadelphia	154,527	154,545	154,545	154,545	154,568	154,591	154,612	154,633	154,653	154,673	154,693	
Westmoreland	34,410	34,415	34,417	34,426	34,430	34,433	34,437	34,440	34,443	34,446	34,449	
York	47,010	47,011	47,022	47,027	47,032	47,037	47,041	47,046	47,049	47,053	47,057	

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.

Pennsylvania Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	6/27	6/28	6/29	6/30	7/2			7/4			7/6					
Allegheny	101,864	101,871	101,886	101,898	101,917	(20,383)	[4,892]	{2,446}	101,935	(20,387)	[4,893]	{2,446}	101,951	(20,390)	[4,894]	{2,447}
Berks	48,449	48,450	48,459	48,467	48,477	(9,695)	[2,327]	{1,163}	48,485	(9,697)	[2,327]	{1,164}	48,493	(9,699)	[2,328]	{1,164}
Bucks	60,804	60,805	60,809	60,816	60,822	(12,164)	[2,919]	{1,460}	60,827	(12,165)	[2,920]	{1,460}	60,831	(12,166)	[2,920]	{1,460}
Butler	17,614	17,617	17,621	17,623	17,627	(3,525)	[846]	{423}	17,630	(3,526)	[846]	{423}	17,633	(3,527)	[846]	{423}
Chester	40,816	40,822	40,827	40,827	40,839	(8,168)	[1,960]	{980}	40,851	(8,170)	[1,961]	{980}	40,863	(8,173)	[1,961]	{981}
Delaware	52,379	52,389	52,386	52,383	52,392	(10,478)	[2,515]	{1,257}	52,401	(10,480)	[2,515]	{1,258}	52,408	(10,482)	[2,516]	{1,258}
Lackawanna	18,556	18,558	18,560	18,561	18,566	(3,713)	[891]	{446}	18,570	(3,714)	[891]	{446}	18,574	(3,715)	[892]	{446}
Lancaster	55,402	55,409	55,415	55,423	55,431	(11,086)	[2,661]	{1,330}	55,439	(11,088)	[2,661]	{1,331}	55,446	(11,089)	[2,661]	{1,331}
Lehigh	39,842	39,840	39,841	39,845	39,850	(7,970)	[1,913]	{956}	39,855	(7,971)	[1,913]	{957}	39,859	(7,972)	[1,913]	{957}
Luzerne	32,101	32,105	32,107	32,118	32,127	(6,425)	[1,542]	{771}	32,135	(6,427)	[1,542]	{771}	32,142	(6,428)	[1,543]	{771}
Monroe	14,821	14,823	14,825	14,827	14,831	(2,966)	[712]	{356}	14,835	(2,967)	[712]	{356}	14,838	(2,968)	[712]	{356}
Montgomery	70,390	70,396	70,400	70,410	70,418	(14,084)	[3,380]	{1,690}	70,426	(14,085)	[3,380]	{1,690}	70,432	(14,086)	[3,381]	{1,690}
Northampton	35,877	35,879	35,885	35,886	35,892	(7,178)	[1,723]	{861}	35,898	(7,180)	[1,723]	{862}	35,904	(7,181)	[1,723]	{862}
Philadelphia	154,527	154,545	154,545	154,545	154,591	(30,918)	[7,420]	{3,710}	154,633	(30,927)	[7,422]	{3,711}	154,673	(30,935)	[7,424]	{3,712}
Westmoreland	34,410	34,415	34,417	34,426	34,433	(6,887)	[1,653]	{826}	34,440	(6,888)	[1,653]	{827}	34,446	(6,889)	[1,653]	{827}
York	47,010	47,011	47,022	47,027	47,037	(9,407)	[2,258]	{1,129}	47,046	(9,409)	[2,258]	{1,129}	47,053	(9,411)	[2,259]	{1,129}

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.