

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 6/29/21**

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 6/29/21 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.

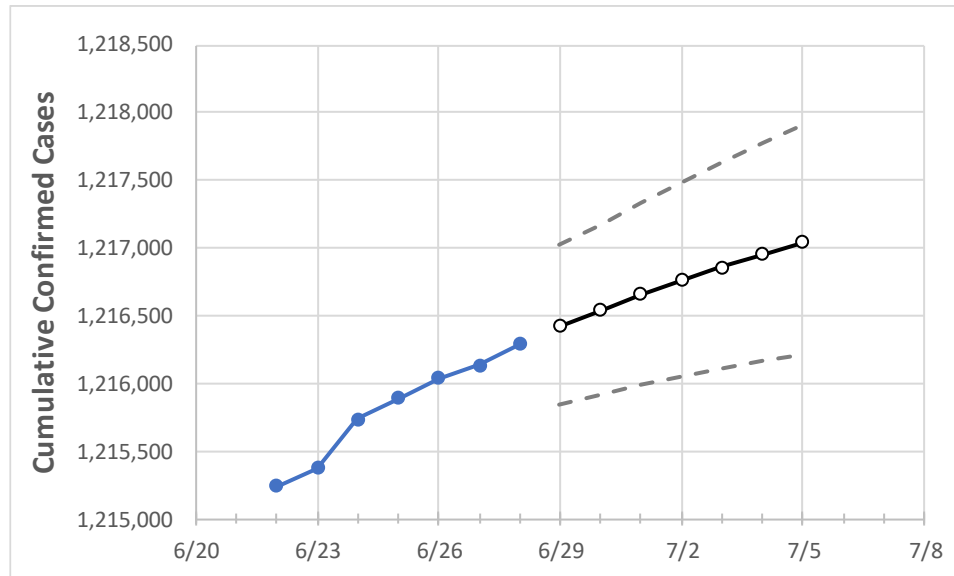
IEM's Modeling Lead

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:							
6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	

Pennsylvania 1,215,889 1,216,037 1,216,133 1,216,293 1,216,420 1,216,539 1,216,658 1,216,762 1,216,860 1,216,953 1,217,043

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:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Allegheny	101,837	101,854	101,864	101,871	101,881	101,891	101,901	101,909	101,918	101,926	101,934
Berks	48,439	48,442	48,449	48,450	48,456	48,461	48,466	48,470	48,474	48,478	48,482
Bucks	60,803	60,804	60,804	60,805	60,808	60,810	60,813	60,815	60,817	60,819	60,820
Butler	17,608	17,611	17,614	17,617	17,619	17,621	17,623	17,625	17,626	17,628	17,629
Chester	40,805	40,811	40,816	40,822	40,828	40,835	40,842	40,848	40,855	40,861	40,868
Delaware	52,367	52,370	52,379	52,389	52,394	52,399	52,403	52,408	52,412	52,416	52,420
Lackawanna	18,548	18,553	18,556	18,556	18,559	18,562	18,565	18,567	18,570	18,572	18,575
Lancaster	55,386	55,394	55,402	55,409	55,413	55,417	55,420	55,424	55,427	55,430	55,432
Lehigh	39,846	39,844	39,842	39,840	39,843	39,847	39,850	39,852	39,855	39,858	39,860
Luzerne	32,088	32,096	32,101	32,105	32,110	32,114	32,118	32,122	32,125	32,129	32,133
Monroe	14,818	14,820	14,821	14,823	14,826	14,828	14,830	14,833	14,835	14,837	14,839
Montgomery	70,381	70,382	70,390	70,396	70,400	70,404	70,408	70,412	70,415	70,418	70,421
Northampton	35,867	35,875	35,877	35,879	35,883	35,886	35,890	35,893	35,897	35,900	35,903
Philadelphia	154,491	154,509	154,527	154,545	154,569	154,591	154,613	154,634	154,656	154,674	154,693
Westmoreland	34,405	34,409	34,410	34,415	34,420	34,425	34,429	34,434	34,438	34,442	34,446
York	46,989	47,004	47,010	47,011	47,016	47,021	47,025	47,030	47,034	47,038	47,041

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:											
	6/25	6/26	6/27	6/28	6/30			7/2			7/4					
Allegheny	101,837	101,854	101,864	101,871	101,891	(20,378)	[4,891]	{2,445}	101,909	(20,382)	[4,892]	{2,446}	101,926	(20,385)	[4,892]	{2,446}
Berks	48,439	48,442	48,449	48,450	48,461	(9,692)	[2,326]	{1,163}	48,470	(9,694)	[2,327]	{1,163}	48,478	(9,696)	[2,327]	{1,163}
Bucks	60,803	60,804	60,804	60,805	60,810	(12,162)	[2,919]	{1,459}	60,815	(12,163)	[2,919]	{1,460}	60,819	(12,164)	[2,919]	{1,460}
Butler	17,608	17,611	17,614	17,617	17,621	(3,524)	[846]	{423}	17,625	(3,525)	[846]	{423}	17,628	(3,526)	[846]	{423}
Chester	40,805	40,811	40,816	40,822	40,835	(8,167)	[1,960]	{980}	40,848	(8,170)	[1,961]	{980}	40,861	(8,172)	[1,961]	{981}
Delaware	52,367	52,370	52,379	52,389	52,399	(10,480)	[2,515]	{1,258}	52,408	(10,482)	[2,516]	{1,258}	52,416	(10,483)	[2,516]	{1,258}
Lackawanna	18,548	18,553	18,556	18,556	18,562	(3,712)	[891]	{445}	18,567	(3,713)	[891]	{446}	18,572	(3,714)	[891]	{446}
Lancaster	55,386	55,394	55,402	55,409	55,417	(11,083)	[2,660]	{1,330}	55,424	(11,085)	[2,660]	{1,330}	55,430	(11,086)	[2,661]	{1,330}
Lehigh	39,846	39,844	39,842	39,840	39,847	(7,969)	[1,913]	{956}	39,852	(7,970)	[1,913]	{956}	39,858	(7,972)	[1,913]	{957}
Luzerne	32,088	32,096	32,101	32,105	32,114	(6,423)	[1,541]	{771}	32,122	(6,424)	[1,542]	{771}	32,129	(6,426)	[1,542]	{771}
Monroe	14,818	14,820	14,821	14,823	14,828	(2,966)	[712]	{356}	14,833	(2,967)	[712]	{356}	14,837	(2,967)	[712]	{356}
Montgomery	70,381	70,382	70,390	70,396	70,404	(14,081)	[3,379]	{1,690}	70,412	(14,082)	[3,380]	{1,690}	70,418	(14,084)	[3,380]	{1,690}
Northampton	35,867	35,875	35,877	35,879	35,886	(7,177)	[1,723]	{861}	35,893	(7,179)	[1,723]	{861}	35,900	(7,180)	[1,723]	{862}
Philadelphia	154,491	154,509	154,527	154,545	154,591	(30,918)	[7,420]	{3,710}	154,634	(30,927)	[7,422]	{3,711}	154,674	(30,935)	[7,424]	{3,712}
Westmoreland	34,405	34,409	34,410	34,415	34,425	(6,885)	[1,652]	{826}	34,434	(6,887)	[1,653]	{826}	34,442	(6,888)	[1,653]	{827}
York	46,989	47,004	47,010	47,011	47,021	(9,404)	[2,257]	{1,129}	47,030	(9,406)	[2,257]	{1,129}	47,038	(9,408)	[2,258]	{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.