

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

Date: 6/17/21

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 6/17/21 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.

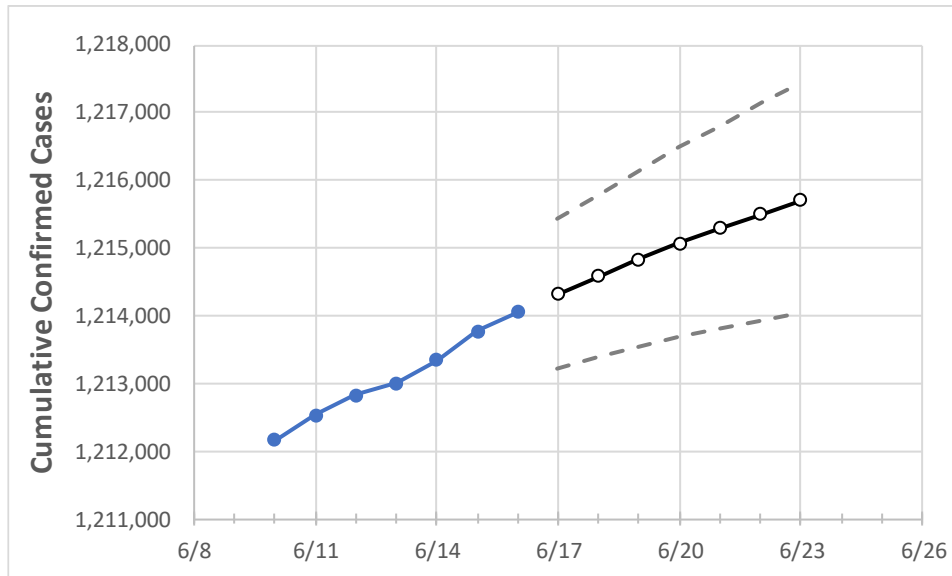
IEM's Modeling Lead

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23

Pennsylvania 1,212,999 1,213,350 1,213,772 1,214,051 1,214,323 1,214,589 1,214,839 1,215,075 1,215,293 1,215,507 1,215,702

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Allegheny	101,646	101,650	101,690	101,715	101,729	101,741	101,754	101,766	101,776	101,786	101,796
Berks	48,293	48,309	48,333	48,349	48,366	48,383	48,400	48,415	48,430	48,445	48,459
Bucks	60,736	60,741	60,744	60,746	60,751	60,756	60,760	60,765	60,769	60,772	60,775
Butler	17,564	17,565	17,575	17,583	17,587	17,590	17,593	17,596	17,598	17,601	17,603
Chester	40,718	40,725	40,736	40,746	40,751	40,755	40,758	40,762	40,766	40,769	40,772
Delaware	52,342	52,338	52,353	52,360	52,374	52,388	52,400	52,412	52,425	52,437	52,448
Lackawanna	18,499	18,500	18,509	18,511	18,513	18,516	18,518	18,520	18,522	18,524	18,526
Lancaster	55,311	55,318	55,322	55,329	55,335	55,341	55,346	55,351	55,355	55,360	55,364
Lehigh	39,774	39,782	39,794	39,800	39,807	39,814	39,821	39,826	39,832	39,837	39,842
Luzerne	32,008	32,012	32,021	32,025	32,034	32,042	32,049	32,057	32,064	32,070	32,076
Monroe	14,775	14,777	14,783	14,788	14,792	14,797	14,801	14,804	14,808	14,812	14,816
Montgomery	70,289	70,295	70,303	70,310	70,317	70,324	70,331	70,337	70,342	70,348	70,353
Northampton	35,797	35,801	35,809	35,823	35,830	35,836	35,841	35,847	35,853	35,859	35,864
Philadelphia	154,043	154,094	154,094	154,094	154,129	154,161	154,192	154,222	154,249	154,275	154,299
Westmoreland	34,290	34,295	34,339	34,368	34,379	34,389	34,400	34,410	34,420	34,430	34,440
York	46,859	46,863	46,884	46,901	46,923	46,946	46,969	46,991	47,011	47,032	47,053

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:											
	6/13	6/14	6/15	6/16	6/18			6/20			6/22					
Allegheny	101,646	101,650	101,690	101,715	101,741	(20,348)	[4,884]	{2,442}	101,766	(20,353)	[4,885]	{2,442}	101,786	(20,357)	[4,886]	{2,443}
Berks	48,293	48,309	48,333	48,349	48,383	(9,677)	[2,322]	{1,161}	48,415	(9,683)	[2,324]	{1,162}	48,445	(9,689)	[2,325]	{1,163}
Bucks	60,736	60,741	60,744	60,746	60,756	(12,151)	[2,916]	{1,458}	60,765	(12,153)	[2,917]	{1,458}	60,772	(12,154)	[2,917]	{1,459}
Butler	17,564	17,565	17,575	17,583	17,590	(3,518)	[844]	{422}	17,596	(3,519)	[845]	{422}	17,601	(3,520)	[845]	{422}
Chester	40,718	40,725	40,736	40,746	40,755	(8,151)	[1,956]	{978}	40,762	(8,152)	[1,957]	{978}	40,769	(8,154)	[1,957]	{978}
Delaware	52,342	52,338	52,353	52,360	52,388	(10,478)	[2,515]	{1,257}	52,412	(10,482)	[2,516]	{1,258}	52,437	(10,487)	[2,517]	{1,258}
Lackawanna	18,499	18,500	18,509	18,511	18,516	(3,703)	[889]	{444}	18,520	(3,704)	[889]	{444}	18,524	(3,705)	[889]	{445}
Lancaster	55,311	55,318	55,322	55,329	55,341	(11,068)	[2,656]	{1,328}	55,351	(11,070)	[2,657]	{1,328}	55,360	(11,072)	[2,657]	{1,329}
Lehigh	39,774	39,782	39,794	39,800	39,814	(7,963)	[1,911]	{956}	39,826	(7,965)	[1,912]	{956}	39,837	(7,967)	[1,912]	{956}
Luzerne	32,008	32,012	32,021	32,025	32,042	(6,408)	[1,538]	{769}	32,057	(6,411)	[1,539]	{769}	32,070	(6,414)	[1,539]	{770}
Monroe	14,775	14,777	14,783	14,788	14,797	(2,959)	[710]	{355}	14,804	(2,961)	[711]	{355}	14,812	(2,962)	[711]	{355}
Montgomery	70,289	70,295	70,303	70,310	70,324	(14,065)	[3,376]	{1,688}	70,337	(14,067)	[3,376]	{1,688}	70,348	(14,070)	[3,377]	{1,688}
Northampton	35,797	35,801	35,809	35,823	35,836	(7,167)	[1,720]	{860}	35,847	(7,169)	[1,721]	{860}	35,859	(7,172)	[1,721]	{861}
Philadelphia	154,043	154,094	154,094	154,094	154,161	(30,832)	[7,400]	{3,700}	154,222	(30,844)	[7,403]	{3,701}	154,275	(30,855)	[7,405]	{3,703}
Westmoreland	34,290	34,295	34,339	34,368	34,389	(6,878)	[1,651]	{825}	34,410	(6,882)	[1,652]	{826}	34,430	(6,886)	[1,653]	{826}
York	46,859	46,863	46,884	46,901	46,946	(9,389)	[2,253]	{1,127}	46,991	(9,398)	[2,256]	{1,128}	47,032	(9,406)	[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.