

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/28/21**

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 7/28/21 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.

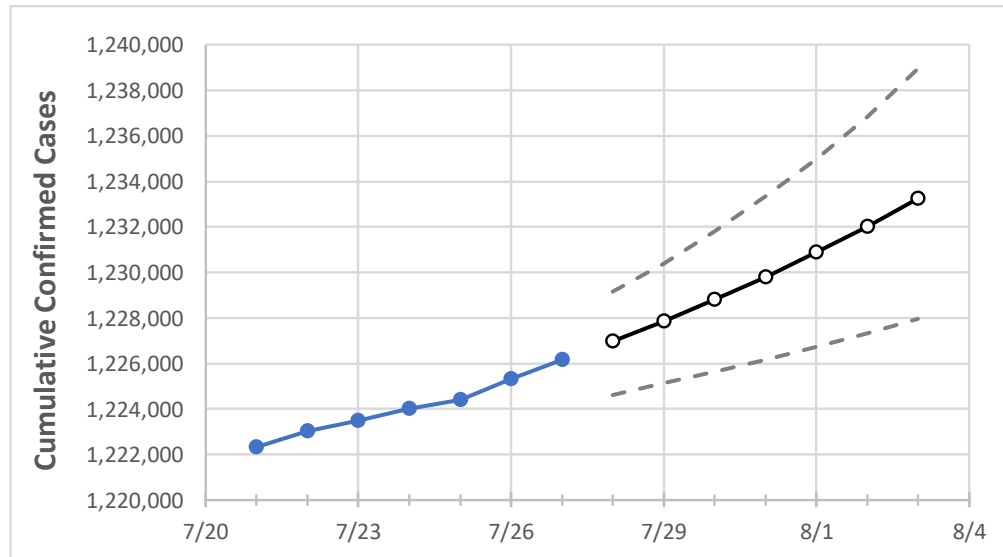
IEM's Modeling Lead

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Pennsylvania	1,224,028	1,224,390	1,225,327	1,226,157	1,226,969	1,227,845	1,228,796	1,229,790	1,230,872	1,232,009	1,233,249

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Allegheny	102,547	102,576	102,664	102,760	102,840	102,928	103,026	103,129	103,247	103,373	103,507
Berks	48,682	48,695	48,709	48,745	48,770	48,798	48,829	48,861	48,895	48,932	48,972
Bucks	61,250	61,284	61,324	61,377	61,426	61,478	61,535	61,595	61,660	61,730	61,804
Butler	17,714	17,718	17,728	17,738	17,746	17,755	17,764	17,773	17,784	17,794	17,805
Chester	41,077	41,100	41,123	41,161	41,194	41,230	41,269	41,313	41,360	41,412	41,469
Delaware	52,708	52,725	52,762	52,813	52,858	52,908	52,962	53,023	53,090	53,165	53,247
Lackawanna	18,666	18,672	18,673	18,686	18,693	18,699	18,706	18,714	18,720	18,728	18,735
Lancaster	55,707	55,727	55,761	55,795	55,833	55,876	55,923	55,974	56,030	56,092	56,159
Lehigh	40,110	40,130	40,144	40,169	40,193	40,219	40,245	40,274	40,303	40,335	40,368
Luzerne	32,290	32,300	32,312	32,339	32,359	32,382	32,406	32,432	32,460	32,490	32,524
Monroe	14,991	14,997	15,006	15,023	15,039	15,056	15,075	15,094	15,115	15,137	15,161
Montgomery	70,950	71,008	71,056	71,129	71,202	71,283	71,370	71,467	71,572	71,686	71,813
Northampton	36,152	36,171	36,188	36,224	36,259	36,296	36,338	36,384	36,434	36,488	36,547
Philadelphia	156,050	156,145	156,240	156,240	156,351	156,468	156,591	156,718	156,851	156,991	157,137
Westmoreland	34,594	34,609	34,617	34,641	34,658	34,677	34,696	34,718	34,740	34,764	34,789
York	47,309	47,324	47,337	47,371	47,394	47,418	47,444	47,472	47,500	47,530	47,562

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:											
	7/24	7/25	7/26	7/27	7/29				7/31				8/2			
Allegheny	102,547	102,576	102,664	102,760	102,928	(20,586)	[4,941]	{2,470}	103,129	(20,626)	[4,950]	{2,475}	103,373	(20,675)	[4,962]	{2,481}
Berks	48,682	48,695	48,709	48,745	48,798	(9,760)	[2,342]	{1,171}	48,861	(9,772)	[2,345]	{1,173}	48,932	(9,786)	[2,349]	{1,174}
Bucks	61,250	61,284	61,324	61,377	61,478	(12,296)	[2,951]	{1,475}	61,595	(12,319)	[2,957]	{1,478}	61,730	(12,346)	[2,963]	{1,482}
Butler	17,714	17,718	17,728	17,738	17,755	(3,551)	[852]	{426}	17,773	(3,555)	[853]	{427}	17,794	(3,559)	[854]	{427}
Chester	41,077	41,100	41,123	41,161	41,230	(8,246)	[1,979]	{990}	41,313	(8,263)	[1,983]	{992}	41,412	(8,282)	[1,988]	{994}
Delaware	52,708	52,725	52,762	52,813	52,908	(10,582)	[2,540]	{1,270}	53,023	(10,605)	[2,545]	{1,273}	53,165	(10,633)	[2,552]	{1,276}
Lackawanna	18,666	18,672	18,673	18,686	18,699	(3,740)	[898]	{449}	18,714	(3,743)	[898]	{449}	18,728	(3,746)	[899]	{449}
Lancaster	55,707	55,727	55,761	55,795	55,876	(11,175)	[2,682]	{1,341}	55,974	(11,195)	[2,687]	{1,343}	56,092	(11,218)	[2,692]	{1,346}
Lehigh	40,110	40,130	40,144	40,169	40,219	(8,044)	[1,930]	{965}	40,274	(8,055)	[1,933]	{967}	40,335	(8,067)	[1,936]	{968}
Luzerne	32,290	32,300	32,312	32,339	32,382	(6,476)	[1,554]	{777}	32,432	(6,486)	[1,557]	{778}	32,490	(6,498)	[1,560]	{780}
Monroe	14,991	14,997	15,006	15,023	15,056	(3,011)	[723]	{361}	15,094	(3,019)	[725]	{362}	15,137	(3,027)	[727]	{363}
Montgomery	70,950	71,008	71,056	71,129	71,283	(14,257)	[3,422]	{1,711}	71,467	(14,293)	[3,430]	{1,715}	71,686	(14,337)	[3,441]	{1,720}
Northampton	36,152	36,171	36,188	36,224	36,296	(7,259)	[1,742]	{871}	36,384	(7,277)	[1,746]	{873}	36,488	(7,298)	[1,751]	{876}
Philadelphia	156,050	156,145	156,240	156,240	156,468	(31,294)	[7,510]	{3,755}	156,718	(31,344)	[7,522]	{3,761}	156,991	(31,398)	[7,536]	{3,768}
Westmoreland	34,594	34,609	34,617	34,641	34,677	(6,935)	[1,664]	{832}	34,718	(6,944)	[1,666]	{833}	34,764	(6,953)	[1,669]	{834}
York	47,309	47,324	47,337	47,371	47,418	(9,484)	[2,276]	{1,138}	47,472	(9,494)	[2,279]	{1,139}	47,530	(9,506)	[2,281]	{1,141}

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.