

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

Date: 9/1/21

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 9/1/21 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.

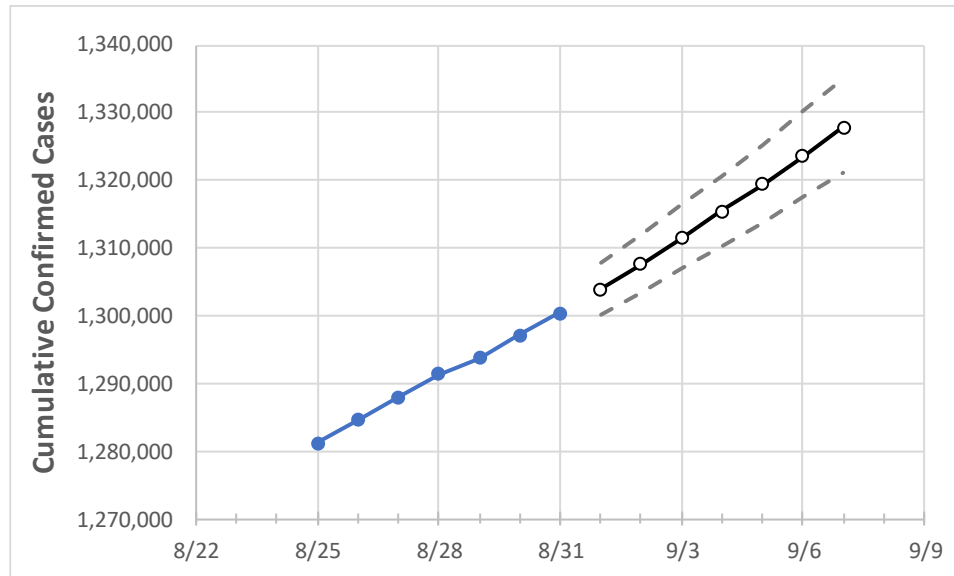
IEM's Modeling Lead

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:							
8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	

Pennsylvania 1,291,324 1,293,764 1,297,119 1,300,368 1,303,948 1,307,666 1,311,470 1,315,370 1,319,385 1,323,588 1,327,888

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:							
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	
Allegheny	108,989	109,226	109,534	109,797	110,120	110,444	110,783	111,130	111,480	111,841	112,213	
Berks	50,654	50,757	50,809	50,958	51,069	51,179	51,298	51,415	51,540	51,667	51,799	
Bucks	64,429	64,607	64,733	64,858	65,016	65,183	65,347	65,520	65,695	65,876	66,061	
Butler	18,895	18,949	19,010	19,080	19,159	19,242	19,326	19,415	19,507	19,603	19,701	
Chester	43,495	43,602	43,708	43,860	43,981	44,105	44,233	44,367	44,500	44,640	44,782	
Delaware	55,450	55,554	55,649	55,757	55,892	56,031	56,173	56,321	56,473	56,630	56,786	
Lackawanna	19,392	19,424	19,448	19,485	19,524	19,562	19,603	19,644	19,686	19,731	19,775	
Lancaster	59,005	59,164	59,269	59,497	59,687	59,877	60,073	60,279	60,495	60,711	60,940	
Lehigh	42,431	42,499	42,550	42,627	42,745	42,862	42,984	43,110	43,237	43,368	43,504	
Luzerne	33,812	33,904	33,974	34,022	34,103	34,186	34,270	34,358	34,449	34,540	34,637	
Monroe	16,021	16,040	16,072	16,115	16,157	16,198	16,240	16,282	16,326	16,370	16,414	
Montgomery	75,103	75,293	75,459	75,596	75,787	75,975	76,173	76,375	76,581	76,793	77,007	
Northampton	38,511	38,584	38,639	38,707	38,801	38,896	38,988	39,082	39,183	39,278	39,377	
Philadelphia	164,978	165,227	165,476	165,761	166,161	166,579	167,013	167,434	167,907	168,357	168,800	
Westmoreland	36,446	36,501	36,626	36,717	36,834	36,960	37,088	37,219	37,360	37,507	37,658	
York	49,972	50,118	50,210	50,362	50,515	50,671	50,833	51,000	51,173	51,350	51,532	

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:											
	8/28	8/29	8/30	8/31	9/2			9/4			9/6					
Allegheny	108,989	109,226	109,534	109,797	110,444	(22,089)	[5,301]	{2,651}	111,130	(22,226)	[5,334]	{2,667}	111,841	(22,368)	[5,368]	{2,684}
Berks	50,654	50,757	50,809	50,958	51,179	(10,236)	[2,457]	{1,228}	51,415	(10,283)	[2,468]	{1,234}	51,667	(10,333)	[2,480]	{1,240}
Bucks	64,429	64,607	64,733	64,858	65,183	(13,037)	[3,129]	{1,564}	65,520	(13,104)	[3,145]	{1,572}	65,876	(13,175)	[3,162]	{1,581}
Butler	18,895	18,949	19,010	19,080	19,242	(3,848)	[924]	{462}	19,415	(3,883)	[932]	{466}	19,603	(3,921)	[941]	{470}
Chester	43,495	43,602	43,708	43,860	44,105	(8,821)	[2,117]	{1,059}	44,367	(8,873)	[2,130]	{1,065}	44,640	(8,928)	[2,143]	{1,071}
Delaware	55,450	55,554	55,649	55,757	56,031	(11,206)	[2,689]	{1,345}	56,321	(11,264)	[2,703]	{1,352}	56,630	(11,326)	[2,718]	{1,359}
Lackawanna	19,392	19,424	19,448	19,485	19,562	(3,912)	[939]	{469}	19,644	(3,929)	[943]	{471}	19,731	(3,946)	[947]	{474}
Lancaster	59,005	59,164	59,269	59,497	59,877	(11,975)	[2,874]	{1,437}	60,279	(12,056)	[2,893]	{1,447}	60,711	(12,142)	[2,914]	{1,457}
Lehigh	42,431	42,499	42,550	42,627	42,862	(8,572)	[2,057]	{1,029}	43,110	(8,622)	[2,069]	{1,035}	43,368	(8,674)	[2,082]	{1,041}
Luzerne	33,812	33,904	33,974	34,022	34,186	(6,837)	[1,641]	{820}	34,358	(6,872)	[1,649]	{825}	34,540	(6,908)	[1,658]	{829}
Monroe	16,021	16,040	16,072	16,115	16,198	(3,240)	[778]	{389}	16,282	(3,256)	[782]	{391}	16,370	(3,274)	[786]	{393}
Montgomery	75,103	75,293	75,459	75,596	75,975	(15,195)	[3,647]	{1,823}	76,375	(15,275)	[3,666]	{1,833}	76,793	(15,359)	[3,686]	{1,843}
Northampton	38,511	38,584	38,639	38,707	38,896	(7,779)	[1,867]	{933}	39,082	(7,816)	[1,876]	{938}	39,278	(7,856)	[1,885]	{943}
Philadelphia	164,978	165,227	165,476	165,761	166,579	(33,316)	[7,996]	{3,998}	167,434	(33,487)	[8,037]	{4,018}	168,357	(33,671)	[8,081]	{4,041}
Westmoreland	36,446	36,501	36,626	36,717	36,960	(7,392)	[1,774]	{887}	37,219	(7,444)	[1,787]	{893}	37,507	(7,501)	[1,800]	{900}
York	49,972	50,118	50,210	50,362	50,671	(10,134)	[2,432]	{1,216}	51,000	(10,200)	[2,448]	{1,224}	51,350	(10,270)	[2,465]	{1,232}

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.