

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/8/21**

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 10/8/21 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.

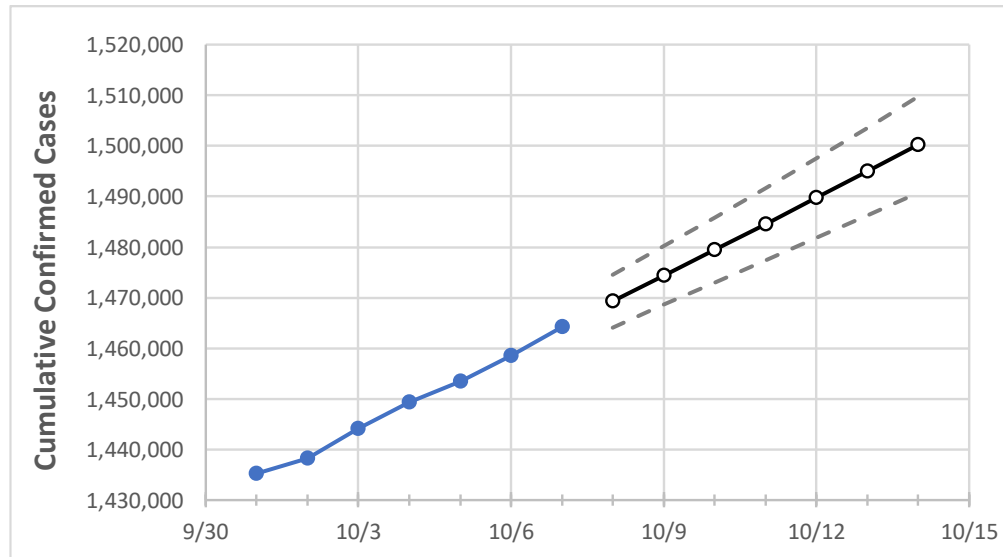
IEM's Modeling Lead

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:							
	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	
Pennsylvania	1,449,368	1,453,387	1,458,445	1,464,264	1,469,295	1,474,367	1,479,486	1,484,543	1,489,724	1,494,946	1,500,163	

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:							
	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	
Allegheny	122,497	122,693	123,164	123,702	124,104	124,495	124,890	125,281	125,685	126,083	126,480	
Berks	55,288	55,421	55,550	55,682	55,835	55,986	56,138	56,296	56,452	56,610	56,771	
Bucks	69,730	69,908	70,059	70,266	70,438	70,612	70,787	70,963	71,148	71,330	71,513	
Butler	22,919	22,981	23,130	23,268	23,399	23,534	23,662	23,799	23,931	24,064	24,202	
Chester	48,073	48,201	48,321	48,461	48,599	48,738	48,879	49,020	49,163	49,307	49,452	
Delaware	59,569	59,637	59,850	59,983	60,097	60,209	60,327	60,444	60,557	60,686	60,801	
Lackawanna	21,443	21,485	21,535	21,616	21,682	21,749	21,817	21,886	21,953	22,022	22,090	
Lancaster	66,614	66,785	66,977	67,266	67,495	67,728	67,953	68,195	68,425	68,664	68,905	
Lehigh	46,432	46,519	46,615	46,741	46,832	46,928	47,017	47,108	47,201	47,290	47,382	
Luzerne	37,848	37,948	38,103	38,284	38,445	38,613	38,779	38,949	39,125	39,299	39,482	
Monroe	18,401	18,447	18,500	18,566	18,622	18,677	18,732	18,786	18,839	18,895	18,948	
Montgomery	81,411	81,632	81,784	81,997	82,177	82,358	82,539	82,723	82,910	83,096	83,284	
Northampton	42,552	42,640	42,700	42,818	42,925	43,021	43,125	43,227	43,329	43,431	43,531	
Philadelphia	175,486	175,804	176,202	176,497	176,788	177,074	177,361	177,658	177,950	178,244	178,539	
Westmoreland	41,427	41,513	41,693	41,900	42,056	42,216	42,376	42,536	42,699	42,864	43,028	
York	57,192	57,361	57,587	57,821	58,051	58,283	58,512	58,742	58,971	59,210	59,446	

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:											
	10/4	10/5	10/6	10/7	10/9				10/11				10/13			
Allegheny	122,497	122,693	123,164	123,702	124,495	(24,899)	[5,976]	{2,988}	125,281	(25,056)	[6,014]	{3,007}	126,083	(25,217)	[6,052]	{3,026}
Berks	55,288	55,421	55,550	55,682	55,986	(11,197)	[2,687]	{1,344}	56,296	(11,259)	[2,702]	{1,351}	56,610	(11,322)	[2,717]	{1,359}
Bucks	69,730	69,908	70,059	70,266	70,612	(14,122)	[3,389]	{1,695}	70,963	(14,193)	[3,406]	{1,703}	71,330	(14,266)	[3,424]	{1,712}
Butler	22,919	22,981	23,130	23,268	23,534	(4,707)	[1,130]	{565}	23,799	(4,760)	[1,142]	{571}	24,064	(4,813)	[1,155]	{578}
Chester	48,073	48,201	48,321	48,461	48,738	(9,748)	[2,339]	{1,170}	49,020	(9,804)	[2,353]	{1,176}	49,307	(9,861)	[2,367]	{1,183}
Delaware	59,569	59,637	59,850	59,983	60,209	(12,042)	[2,890]	{1,445}	60,444	(12,089)	[2,901]	{1,451}	60,686	(12,137)	[2,913]	{1,456}
Lackawanna	21,443	21,485	21,535	21,616	21,749	(4,350)	[1,044]	{522}	21,886	(4,377)	[1,051]	{525}	22,022	(4,404)	[1,057]	{529}
Lancaster	66,614	66,785	66,977	67,266	67,728	(13,546)	[3,251]	{1,625}	68,195	(13,639)	[3,273]	{1,637}	68,664	(13,733)	[3,296]	{1,648}
Lehigh	46,432	46,519	46,615	46,741	46,928	(9,386)	[2,253]	{1,126}	47,108	(9,422)	[2,261]	{1,131}	47,290	(9,458)	[2,270]	{1,135}
Luzerne	37,848	37,948	38,103	38,284	38,613	(7,723)	[1,853]	{927}	38,949	(7,790)	[1,870]	{935}	39,299	(7,860)	[1,886]	{943}
Monroe	18,401	18,447	18,500	18,566	18,677	(3,735)	[896]	{448}	18,786	(3,757)	[902]	{451}	18,895	(3,779)	[907]	{453}
Montgomery	81,411	81,632	81,784	81,997	82,358	(16,472)	[3,953]	{1,977}	82,723	(16,545)	[3,971]	{1,985}	83,096	(16,619)	[3,989]	{1,994}
Northampton	42,552	42,640	42,700	42,818	43,021	(8,604)	[2,065]	{1,033}	43,227	(8,645)	[2,075]	{1,037}	43,431	(8,686)	[2,085]	{1,042}
Philadelphia	175,486	175,804	176,202	176,497	177,074	(35,415)	[8,500]	{4,250}	177,658	(35,532)	[8,528]	{4,264}	178,244	(35,649)	[8,556]	{4,278}
Westmoreland	41,427	41,513	41,693	41,900	42,216	(8,443)	[2,026]	{1,013}	42,536	(8,507)	[2,042]	{1,021}	42,864	(8,573)	[2,057]	{1,029}
York	57,192	57,361	57,587	57,821	58,283	(11,657)	[2,798]	{1,399}	58,742	(11,748)	[2,820]	{1,410}	59,210	(11,842)	[2,842]	{1,421}

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.