

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 10/1/21**

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 10/1/21 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.**

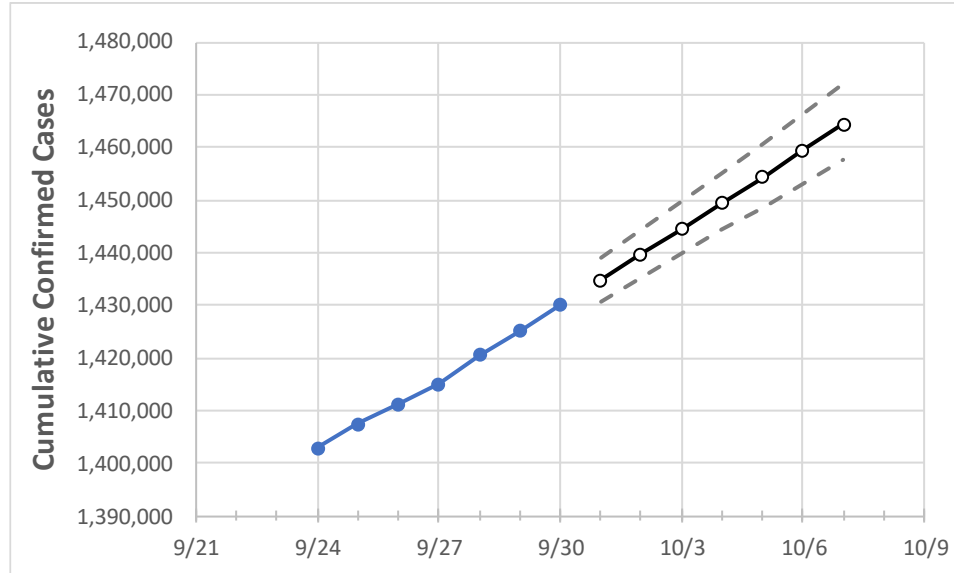
**IEM's Modeling Lead**

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:							
9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	

Pennsylvania 1,415,049 1,420,478 1,425,048 1,429,940 1,434,777 1,439,662 1,444,510 1,449,461 1,454,360 1,459,465 1,464,472

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:							
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	
Allegheny	119,718	120,154	120,573	120,934	121,355	121,777	122,200	122,627	123,050	123,490	123,935	
Berks	54,219	54,382	54,514	54,648	54,784	54,923	55,061	55,201	55,340	55,484	55,628	
Bucks	68,647	68,781	68,881	69,039	69,182	69,327	69,467	69,612	69,757	69,901	70,048	
Butler	21,991	22,110	22,254	22,401	22,528	22,654	22,782	22,912	23,044	23,180	23,314	
Chester	47,148	47,264	47,387	47,513	47,634	47,758	47,878	48,001	48,124	48,245	48,369	
Delaware	58,815	58,929	59,037	59,157	59,256	59,360	59,457	59,560	59,660	59,761	59,862	
Lackawanna	20,977	21,027	21,078	21,170	21,241	21,313	21,384	21,457	21,534	21,610	21,687	
Lancaster	65,020	65,188	65,403	65,616	65,834	66,057	66,276	66,495	66,719	66,946	67,167	
Lehigh	45,746	45,834	45,914	46,034	46,139	46,242	46,344	46,446	46,549	46,653	46,753	
Luzerne	36,808	36,918	37,061	37,200	37,336	37,473	37,609	37,751	37,895	38,042	38,188	
Monroe	17,985	18,063	18,118	18,202	18,270	18,339	18,408	18,478	18,546	18,617	18,686	
Montgomery	80,275	80,435	80,576	80,719	80,887	81,053	81,216	81,380	81,549	81,715	81,883	
Northampton	41,791	41,922	42,017	42,137	42,248	42,357	42,463	42,574	42,680	42,792	42,900	
Philadelphia	173,451	173,871	174,141	174,478	174,795	175,101	175,409	175,726	176,032	176,351	176,677	
Westmoreland	40,274	40,486	40,668	40,788	40,959	41,121	41,290	41,467	41,638	41,821	41,995	
York	55,654	55,880	56,079	56,293	56,517	56,744	56,973	57,200	57,433	57,667	57,904	

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:											
	9/27	9/28	9/29	9/30	10/2			10/4			10/6					
Allegheny	119,718	120,154	120,573	120,934	121,777	(24,355)	[5,845]	{2,923}	122,627	(24,525)	[5,886]	{2,943}	123,490	(24,698)	[5,928]	{2,964}
Berks	54,219	54,382	54,514	54,648	54,923	(10,985)	[2,636]	{1,318}	55,201	(11,040)	[2,650]	{1,325}	55,484	(11,097)	[2,663]	{1,332}
Bucks	68,647	68,781	68,881	69,039	69,327	(13,865)	[3,328]	{1,664}	69,612	(13,922)	[3,341]	{1,671}	69,901	(13,980)	[3,355]	{1,678}
Butler	21,991	22,110	22,254	22,401	22,654	(4,531)	[1,087]	{544}	22,912	(4,582)	[1,100]	{550}	23,180	(4,636)	[1,113]	{556}
Chester	47,148	47,264	47,387	47,513	47,758	(9,552)	[2,292]	{1,146}	48,001	(9,600)	[2,304]	{1,152}	48,245	(9,649)	[2,316]	{1,158}
Delaware	58,815	58,929	59,037	59,157	59,360	(11,872)	[2,849]	{1,425}	59,560	(11,912)	[2,859]	{1,429}	59,761	(11,952)	[2,869]	{1,434}
Lackawanna	20,977	21,027	21,078	21,170	21,313	(4,263)	[1,023]	{512}	21,457	(4,291)	[1,030]	{515}	21,610	(4,322)	[1,037]	{519}
Lancaster	65,020	65,188	65,403	65,616	66,057	(13,211)	[3,171]	{1,585}	66,495	(13,299)	[3,192]	{1,596}	66,946	(13,389)	[3,213]	{1,607}
Lehigh	45,746	45,834	45,914	46,034	46,242	(9,248)	[2,220]	{1,110}	46,446	(9,289)	[2,229]	{1,115}	46,653	(9,331)	[2,239]	{1,120}
Luzerne	36,808	36,918	37,061	37,200	37,473	(7,495)	[1,799]	{899}	37,751	(7,550)	[1,812]	{906}	38,042	(7,608)	[1,826]	{913}
Monroe	17,985	18,063	18,118	18,202	18,339	(3,668)	[880]	{440}	18,478	(3,696)	[887]	{443}	18,617	(3,723)	[894]	{447}
Montgomery	80,275	80,435	80,576	80,719	81,053	(16,211)	[3,891]	{1,945}	81,380	(16,276)	[3,906]	{1,953}	81,715	(16,343)	[3,922]	{1,961}
Northampton	41,791	41,922	42,017	42,137	42,357	(8,471)	[2,033]	{1,017}	42,574	(8,515)	[2,044]	{1,022}	42,792	(8,558)	[2,054]	{1,027}
Philadelphia	173,451	173,871	174,141	174,478	175,101	(35,020)	[8,405]	{4,202}	175,726	(35,145)	[8,435]	{4,217}	176,351	(35,270)	[8,465]	{4,232}
Westmoreland	40,274	40,486	40,668	40,788	41,121	(8,224)	[1,974]	{987}	41,467	(8,293)	[1,990]	{995}	41,821	(8,364)	[2,007]	{1,004}
York	55,654	55,880	56,079	56,293	56,744	(11,349)	[2,724]	{1,362}	57,200	(11,440)	[2,746]	{1,373}	57,667	(11,533)	[2,768]	{1,384}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.