

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 7/23/21**

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 7/23/21 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.**

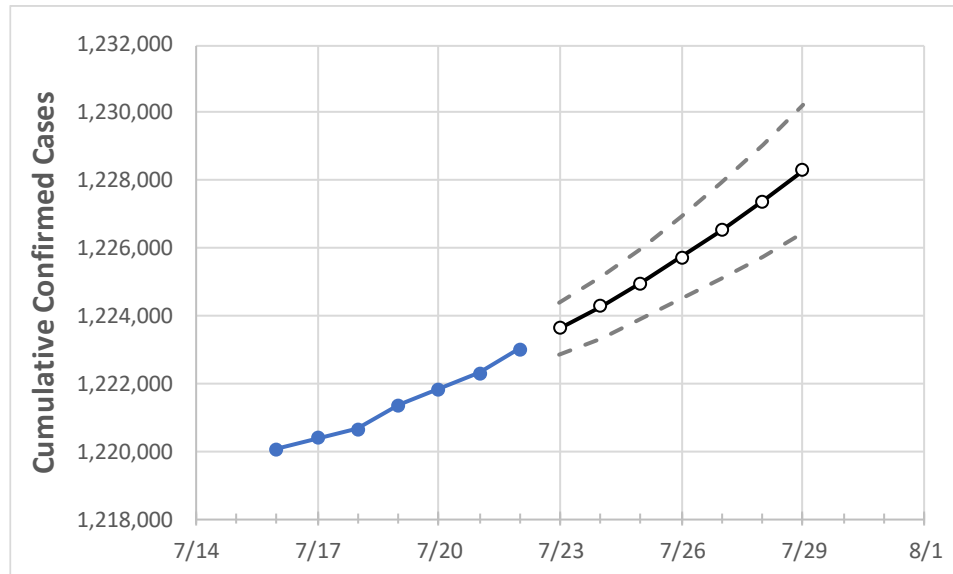
**IEM's Modeling Lead**

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:							
7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	

Pennsylvania 1,221,350 1,221,836 1,222,311 1,223,026 1,223,626 1,224,272 1,224,966 1,225,721 1,226,524 1,227,385 1,228,302

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:							
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	
Allegheny	102,273	102,344	102,398	102,449	102,492	102,538	102,586	102,637	102,692	102,748	102,808	
Berks	48,593	48,612	48,630	48,640	48,653	48,667	48,682	48,697	48,713	48,730	48,747	
Bucks	61,091	61,118	61,148	61,181	61,216	61,255	61,296	61,342	61,391	61,443	61,500	
Butler	17,686	17,693	17,701	17,706	17,712	17,719	17,726	17,733	17,741	17,748	17,757	
Chester	40,971	40,982	41,005	41,025	41,041	41,057	41,074	41,093	41,112	41,132	41,153	
Delaware	52,565	52,579	52,601	52,636	52,655	52,675	52,696	52,718	52,742	52,765	52,791	
Lackawanna	18,634	18,641	18,647	18,650	18,656	18,662	18,669	18,675	18,682	18,689	18,696	
Lancaster	55,573	55,599	55,621	55,655	55,680	55,708	55,739	55,771	55,807	55,845	55,887	
Lehigh	40,016	40,035	40,058	40,068	40,086	40,105	40,125	40,146	40,168	40,191	40,215	
Luzerne	32,214	32,220	32,234	32,252	32,261	32,270	32,279	32,289	32,299	32,309	32,319	
Monroe	14,923	14,939	14,948	14,964	14,977	14,991	15,006	15,022	15,039	15,057	15,077	
Montgomery	70,716	70,747	70,790	70,844	70,887	70,933	70,983	71,038	71,097	71,161	71,230	
Northampton	36,021	36,056	36,080	36,099	36,120	36,144	36,170	36,198	36,228	36,260	36,295	
Philadelphia	155,608	155,692	155,775	155,859	155,947	156,039	156,135	156,239	156,348	156,461	156,581	
Westmoreland	34,535	34,552	34,563	34,576	34,588	34,600	34,613	34,627	34,641	34,656	34,672	
York	47,206	47,226	47,250	47,268	47,283	47,299	47,315	47,331	47,348	47,365	47,383	

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:											
	7/19	7/20	7/21	7/22	7/24				7/26				7/28			
Allegheny	102,273	102,344	102,398	102,449	102,538	(20,508)	[4,922]	{2,461}	102,637	(20,527)	[4,927]	{2,463}	102,748	(20,550)	[4,932]	{2,466}
Berks	48,593	48,612	48,630	48,640	48,667	(9,733)	[2,336]	{1,168}	48,697	(9,739)	[2,337]	{1,169}	48,730	(9,746)	[2,339]	{1,170}
Bucks	61,091	61,118	61,148	61,181	61,255	(12,251)	[2,940]	{1,470}	61,342	(12,268)	[2,944]	{1,472}	61,443	(12,289)	[2,949]	{1,475}
Butler	17,686	17,693	17,701	17,706	17,719	(3,544)	[851]	{425}	17,733	(3,547)	[851]	{426}	17,748	(3,550)	[852]	{426}
Chester	40,971	40,982	41,005	41,025	41,057	(8,211)	[1,971]	{985}	41,093	(8,219)	[1,972]	{986}	41,132	(8,226)	[1,974]	{987}
Delaware	52,565	52,579	52,601	52,636	52,675	(10,535)	[2,528]	{1,264}	52,718	(10,544)	[2,530]	{1,265}	52,765	(10,553)	[2,533]	{1,266}
Lackawanna	18,634	18,641	18,647	18,650	18,662	(3,732)	[896]	{448}	18,675	(3,735)	[896]	{448}	18,689	(3,738)	[897]	{449}
Lancaster	55,573	55,599	55,621	55,655	55,708	(11,142)	[2,674]	{1,337}	55,771	(11,154)	[2,677]	{1,339}	55,845	(11,169)	[2,681]	{1,340}
Lehigh	40,016	40,035	40,058	40,068	40,105	(8,021)	[1,925]	{963}	40,146	(8,029)	[1,927]	{963}	40,191	(8,038)	[1,929]	{965}
Luzerne	32,214	32,220	32,234	32,252	32,270	(6,454)	[1,549]	{774}	32,289	(6,458)	[1,550]	{775}	32,309	(6,462)	[1,551]	{775}
Monroe	14,923	14,939	14,948	14,964	14,991	(2,998)	[720]	{360}	15,022	(3,004)	[721]	{361}	15,057	(3,011)	[723]	{361}
Montgomery	70,716	70,747	70,790	70,844	70,933	(14,187)	[3,405]	{1,702}	71,038	(14,208)	[3,410]	{1,705}	71,161	(14,232)	[3,416]	{1,708}
Northampton	36,021	36,056	36,080	36,099	36,144	(7,229)	[1,735]	{867}	36,198	(7,240)	[1,737]	{869}	36,260	(7,252)	[1,740]	{870}
Philadelphia	155,608	155,692	155,775	155,859	156,039	(31,208)	[7,490]	{3,745}	156,239	(31,248)	[7,499]	{3,750}	156,461	(31,292)	[7,510]	{3,755}
Westmoreland	34,535	34,552	34,563	34,576	34,600	(6,920)	[1,661]	{830}	34,627	(6,925)	[1,662]	{831}	34,656	(6,931)	[1,663]	{832}
York	47,206	47,226	47,250	47,268	47,299	(9,460)	[2,270]	{1,135}	47,331	(9,466)	[2,272]	{1,136}	47,365	(9,473)	[2,274]	{1,137}

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.