

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

Date: 8/6/21

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 8/6/21 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.**

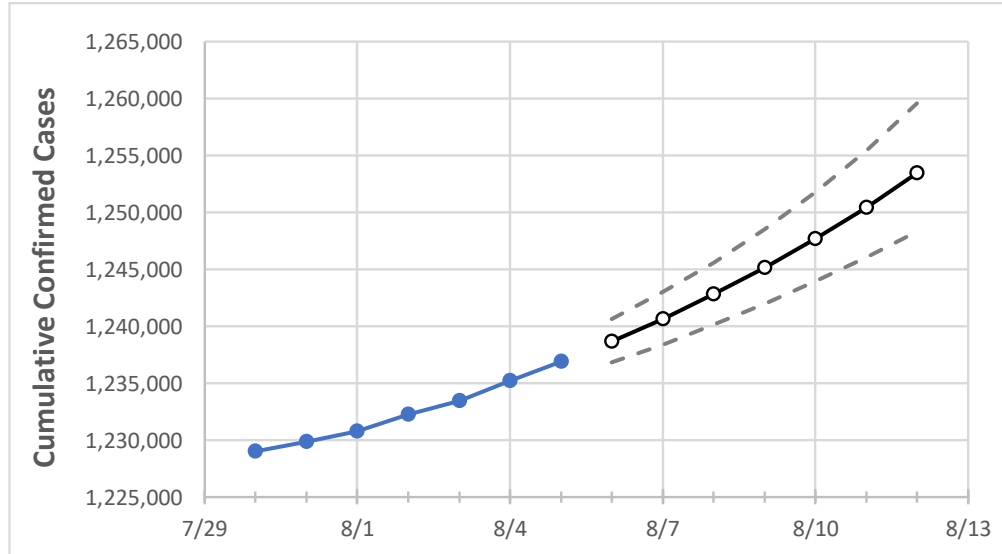
### IEM's Modeling Lead

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:							
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	
Pennsylvania	1,232,238	1,233,461	1,235,196	1,236,887	1,238,677	1,240,642	1,242,805	1,245,140	1,247,653	1,250,444	1,253,486	

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:							
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	
Allegheny	103,378	103,529	103,646	103,866	104,062	104,276	104,506	104,764	105,051	105,368	105,711	
Berks	48,894	48,927	48,971	49,017	49,060	49,106	49,156	49,209	49,265	49,326	49,390	
Bucks	61,687	61,757	61,835	61,917	62,002	62,091	62,187	62,290	62,401	62,518	62,644	
Butler	17,834	17,845	17,872	17,906	17,936	17,970	18,007	18,048	18,094	18,145	18,203	
Chester	41,380	41,423	41,470	41,541	41,605	41,675	41,750	41,831	41,920	42,015	42,118	
Delaware	53,092	53,162	53,221	53,292	53,367	53,448	53,535	53,631	53,732	53,841	53,958	
Lackawanna	18,748	18,768	18,788	18,812	18,833	18,855	18,880	18,908	18,937	18,970	19,006	
Lancaster	56,081	56,138	56,223	56,306	56,394	56,489	56,595	56,712	56,842	56,981	57,136	
Lehigh	40,332	40,379	40,432	40,485	40,538	40,595	40,657	40,725	40,797	40,877	40,962	
Luzerne	32,502	32,536	32,577	32,629	32,678	32,734	32,795	32,861	32,931	33,009	33,095	
Monroe	15,120	15,161	15,191	15,203	15,228	15,253	15,282	15,310	15,341	15,373	15,407	
Montgomery	71,588	71,657	71,759	71,880	71,996	72,120	72,253	72,395	72,546	72,706	72,876	
Northampton	36,459	36,535	36,609	36,657	36,730	36,810	36,897	36,989	37,093	37,209	37,331	
Philadelphia	157,274	157,512	157,749	157,951	158,184	158,434	158,700	158,984	159,288	159,611	159,956	
Westmoreland	34,794	34,825	34,852	34,886	34,925	34,967	35,013	35,062	35,114	35,173	35,235	
York	47,571	47,615	47,671	47,724	47,781	47,841	47,906	47,978	48,056	48,140	48,229	

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:											
	8/2	8/3	8/4	8/5	8/7				8/9				8/11			
Allegheny	103,378	103,529	103,646	103,866	104,276	(20,855)	[5,005]	{2,503}	104,764	(20,953)	[5,029]	{2,514}	105,368	(21,074)	[5,058]	{2,529}
Berks	48,894	48,927	48,971	49,017	49,106	(9,821)	[2,357]	{1,179}	49,209	(9,842)	[2,362]	{1,181}	49,326	(9,865)	[2,368]	{1,184}
Bucks	61,687	61,757	61,835	61,917	62,091	(12,418)	[2,980]	{1,490}	62,290	(12,458)	[2,990]	{1,495}	62,518	(12,504)	[3,001]	{1,500}
Butler	17,834	17,845	17,872	17,906	17,970	(3,594)	[863]	{431}	18,048	(3,610)	[866]	{433}	18,145	(3,629)	[871]	{435}
Chester	41,380	41,423	41,470	41,541	41,675	(8,335)	[2,000]	{1,000}	41,831	(8,366)	[2,008]	{1,004}	42,015	(8,403)	[2,017]	{1,008}
Delaware	53,092	53,162	53,221	53,292	53,448	(10,690)	[2,565]	{1,283}	53,631	(10,726)	[2,574]	{1,287}	53,841	(10,768)	[2,584]	{1,292}
Lackawanna	18,748	18,768	18,788	18,812	18,855	(3,771)	[905]	{453}	18,908	(3,782)	[908]	{454}	18,970	(3,794)	[911]	{455}
Lancaster	56,081	56,138	56,223	56,306	56,489	(11,298)	[2,711]	{1,356}	56,712	(11,342)	[2,722]	{1,361}	56,981	(11,396)	[2,735]	{1,368}
Lehigh	40,332	40,379	40,432	40,485	40,595	(8,119)	[1,949]	{974}	40,725	(8,145)	[1,955]	{977}	40,877	(8,175)	[1,962]	{981}
Luzerne	32,502	32,536	32,577	32,629	32,734	(6,547)	[1,571]	{786}	32,861	(6,572)	[1,577]	{789}	33,009	(6,602)	[1,584]	{792}
Monroe	15,120	15,161	15,191	15,203	15,253	(3,051)	[732]	{366}	15,310	(3,062)	[735]	{367}	15,373	(3,075)	[738]	{369}
Montgomery	71,588	71,657	71,759	71,880	72,120	(14,424)	[3,462]	{1,731}	72,395	(14,479)	[3,475]	{1,737}	72,706	(14,541)	[3,490]	{1,745}
Northampton	36,459	36,535	36,609	36,657	36,810	(7,362)	[1,767]	{883}	36,989	(7,398)	[1,775]	{888}	37,209	(7,442)	[1,786]	{893}
Philadelphia	157,274	157,512	157,749	157,951	158,434	(31,687)	[7,605]	{3,802}	158,984	(31,797)	[7,631]	{3,816}	159,611	(31,922)	[7,661]	{3,831}
Westmoreland	34,794	34,825	34,852	34,886	34,967	(6,993)	[1,678]	{839}	35,062	(7,012)	[1,683]	{841}	35,173	(7,035)	[1,688]	{844}
York	47,571	47,615	47,671	47,724	47,841	(9,568)	[2,296]	{1,148}	47,978	(9,596)	[2,303]	{1,151}	48,140	(9,628)	[2,311]	{1,155}

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.