

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 8/11/21**

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 8/11/21 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.**

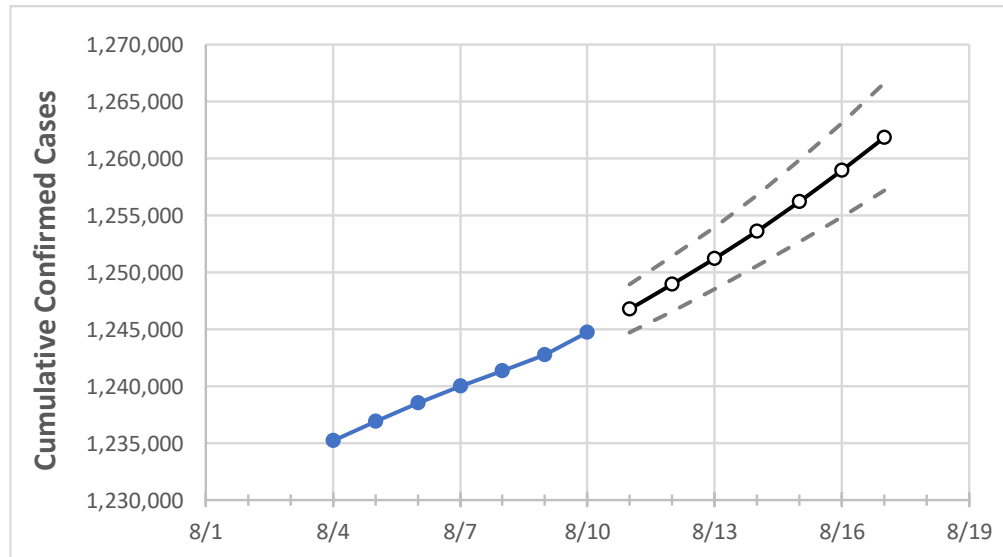
**IEM's Modeling Lead**

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Pennsylvania	1,239,996	1,241,360	1,242,724	1,244,753	1,246,784	1,248,928	1,251,211	1,253,630	1,256,211	1,258,934	1,261,853

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Allegheny	104,185	104,308	104,430	104,658	104,877	105,105	105,356	105,622	105,911	106,217	106,544
Berks	49,128	49,163	49,197	49,254	49,311	49,372	49,437	49,506	49,579	49,657	49,741
Bucks	62,105	62,183	62,261	62,335	62,436	62,543	62,656	62,777	62,903	63,035	63,176
Butler	17,964	17,982	17,999	18,026	18,058	18,094	18,132	18,172	18,217	18,264	18,314
Chester	41,670	41,731	41,791	41,871	41,954	42,043	42,139	42,243	42,354	42,473	42,601
Delaware	53,453	53,510	53,567	53,663	53,758	53,856	53,961	54,074	54,196	54,324	54,460
Lackawanna	18,851	18,864	18,877	18,896	18,918	18,942	18,967	18,994	19,023	19,054	19,086
Lancaster	56,482	56,554	56,626	56,712	56,818	56,931	57,052	57,182	57,321	57,471	57,631
Lehigh	40,620	40,652	40,684	40,765	40,833	40,907	40,987	41,074	41,164	41,263	41,368
Luzerne	32,730	32,756	32,781	32,832	32,886	32,945	33,007	33,073	33,146	33,222	33,305
Monroe	15,275	15,294	15,313	15,349	15,382	15,418	15,456	15,495	15,537	15,583	15,630
Montgomery	72,101	72,207	72,313	72,435	72,571	72,714	72,865	73,025	73,194	73,371	73,558
Northampton	36,806	36,848	36,890	36,961	37,040	37,125	37,215	37,311	37,411	37,519	37,634
Philadelphia	158,302	158,475	158,648	158,877	159,126	159,389	159,664	159,953	160,256	160,572	160,899
Westmoreland	34,957	34,977	34,996	35,069	35,115	35,163	35,215	35,269	35,329	35,394	35,462
York	47,847	47,896	47,945	48,022	48,096	48,176	48,261	48,354	48,452	48,557	48,671

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:											
	8/7	8/8	8/9	8/10	8/12				8/14				8/16			
Allegheny	104,185	104,308	104,430	104,658	105,105	(21,021)	[5,045]	{2,523}	105,622	(21,124)	[5,070]	{2,535}	106,217	(21,243)	[5,098]	{2,549}
Berks	49,128	49,163	49,197	49,254	49,372	(9,874)	[2,370]	{1,185}	49,506	(9,901)	[2,376]	{1,188}	49,657	(9,931)	[2,384]	{1,192}
Bucks	62,105	62,183	62,261	62,335	62,543	(12,509)	[3,002]	{1,501}	62,777	(12,555)	[3,013]	{1,507}	63,035	(12,607)	[3,026]	{1,513}
Butler	17,964	17,982	17,999	18,026	18,094	(3,619)	[869]	{434}	18,172	(3,634)	[872]	{436}	18,264	(3,653)	[877]	{438}
Chester	41,670	41,731	41,791	41,871	42,043	(8,409)	[2,018]	{1,009}	42,243	(8,449)	[2,028]	{1,014}	42,473	(8,495)	[2,039]	{1,019}
Delaware	53,453	53,510	53,567	53,663	53,856	(10,771)	[2,585]	{1,293}	54,074	(10,815)	[2,596]	{1,298}	54,324	(10,865)	[2,608]	{1,304}
Lackawanna	18,851	18,864	18,877	18,896	18,942	(3,788)	[909]	{455}	18,994	(3,799)	[912]	{456}	19,054	(3,811)	[915]	{457}
Lancaster	56,482	56,554	56,626	56,712	56,931	(11,386)	[2,733]	{1,366}	57,182	(11,436)	[2,745]	{1,372}	57,471	(11,494)	[2,759]	{1,379}
Lehigh	40,620	40,652	40,684	40,765	40,907	(8,181)	[1,964]	{982}	41,074	(8,215)	[1,972]	{986}	41,263	(8,253)	[1,981]	{990}
Luzerne	32,730	32,756	32,781	32,832	32,945	(6,589)	[1,581]	{791}	33,073	(6,615)	[1,588]	{794}	33,222	(6,644)	[1,595]	{797}
Monroe	15,275	15,294	15,313	15,349	15,418	(3,084)	[740]	{370}	15,495	(3,099)	[744]	{372}	15,583	(3,117)	[748]	{374}
Montgomery	72,101	72,207	72,313	72,435	72,714	(14,543)	[3,490]	{1,745}	73,025	(14,605)	[3,505]	{1,753}	73,371	(14,674)	[3,522]	{1,761}
Northampton	36,806	36,848	36,890	36,961	37,125	(7,425)	[1,782]	{891}	37,311	(7,462)	[1,791]	{895}	37,519	(7,504)	[1,801]	{900}
Philadelphia	158,302	158,475	158,648	158,877	159,389	(31,878)	[7,651]	{3,825}	159,953	(31,991)	[7,678]	{3,839}	160,572	(32,114)	[7,707]	{3,854}
Westmoreland	34,957	34,977	34,996	35,069	35,163	(7,033)	[1,688]	{844}	35,269	(7,054)	[1,693]	{846}	35,394	(7,079)	[1,699]	{849}
York	47,847	47,896	47,945	48,022	48,176	(9,635)	[2,312]	{1,156}	48,354	(9,671)	[2,321]	{1,161}	48,557	(9,711)	[2,331]	{1,165}

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.