

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

Date: 6/24/21

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 6/24/21 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.**

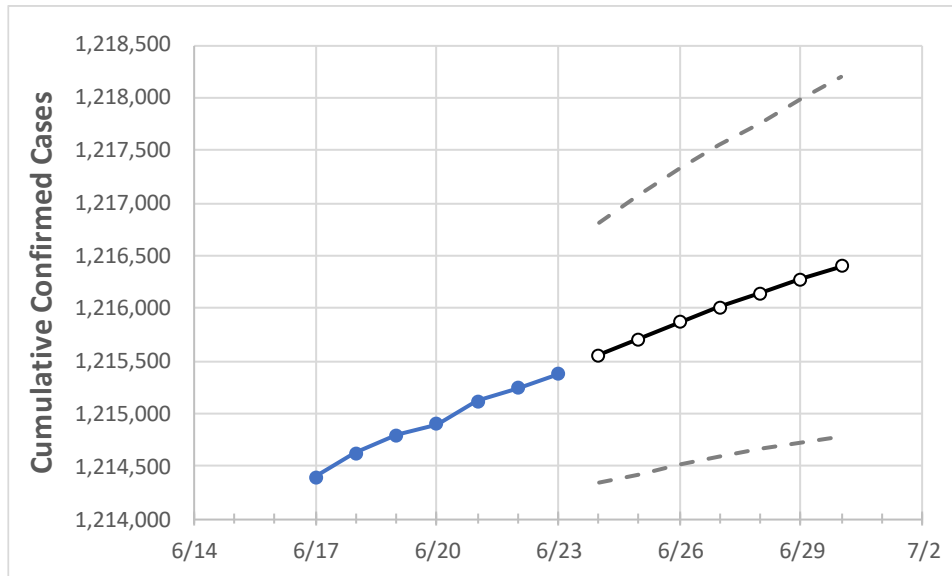
### IEM's Modeling Lead

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:						
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30

Pennsylvania 1,214,895 1,215,116 1,215,239 1,215,374 1,215,550 1,215,710 1,215,868 1,216,014 1,216,145 1,216,271 1,216,394

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:						
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30
Allegheny	101,776	101,780	101,795	101,801	101,812	101,821	101,830	101,838	101,846	101,854	101,860
Berks	48,394	48,404	48,414	48,432	48,443	48,453	48,464	48,473	48,483	48,492	48,500
Bucks	60,773	60,776	60,782	60,785	60,788	60,792	60,794	60,797	60,800	60,802	60,804
Butler	17,599	17,601	17,602	17,605	17,608	17,610	17,613	17,615	17,618	17,620	17,622
Chester	40,770	40,774	40,787	40,795	40,800	40,806	40,811	40,816	40,820	40,825	40,830
Delaware	52,366	52,375	52,349	52,356	52,364	52,371	52,379	52,386	52,392	52,399	52,405
Lackawanna	18,533	18,535	18,539	18,540	18,543	18,545	18,548	18,551	18,553	18,555	18,557
Lancaster	55,362	55,365	55,371	55,375	55,379	55,384	55,387	55,391	55,394	55,397	55,400
Lehigh	39,817	39,824	39,828	39,835	39,840	39,844	39,848	39,852	39,856	39,859	39,862
Luzerne	32,049	32,054	32,067	32,074	32,080	32,086	32,092	32,097	32,103	32,108	32,113
Monroe	14,802	14,805	14,808	14,810	14,814	14,817	14,820	14,823	14,826	14,829	14,832
Montgomery	70,360	70,369	70,368	70,368	70,375	70,382	70,388	70,393	70,399	70,404	70,409
Northampton	35,841	35,849	35,853	35,855	35,859	35,864	35,868	35,872	35,875	35,879	35,883
Philadelphia	154,261	154,286	154,286	154,286	154,308	154,329	154,349	154,368	154,386	154,402	154,417
Westmoreland	34,379	34,381	34,383	34,386	34,393	34,399	34,406	34,412	34,418	34,424	34,429
York	46,946	46,951	46,960	46,971	46,984	46,997	47,008	47,019	47,030	47,042	47,051

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:											
	6/20	6/21	6/22	6/23	6/25			6/27			6/29					
Allegheny	101,776	101,780	101,795	101,801	101,821	(20,364)	[4,887]	{2,444}	101,838	(20,368)	[4,888]	{2,444}	101,854	(20,371)	[4,889]	{2,444}
Berks	48,394	48,404	48,414	48,432	48,453	(9,691)	[2,326]	{1,163}	48,473	(9,695)	[2,327]	{1,163}	48,492	(9,698)	[2,328]	{1,164}
Bucks	60,773	60,776	60,782	60,785	60,792	(12,158)	[2,918]	{1,459}	60,797	(12,159)	[2,918]	{1,459}	60,802	(12,160)	[2,918]	{1,459}
Butler	17,599	17,601	17,602	17,605	17,610	(3,522)	[845]	{423}	17,615	(3,523)	[846]	{423}	17,620	(3,524)	[846]	{423}
Chester	40,770	40,774	40,787	40,795	40,806	(8,161)	[1,959]	{979}	40,816	(8,163)	[1,959]	{980}	40,825	(8,165)	[1,960]	{980}
Delaware	52,366	52,375	52,349	52,356	52,371	(10,474)	[2,514]	{1,257}	52,386	(10,477)	[2,515]	{1,257}	52,399	(10,480)	[2,515]	{1,258}
Lackawanna	18,533	18,535	18,539	18,540	18,545	(3,709)	[890]	{445}	18,551	(3,710)	[890]	{445}	18,555	(3,711)	[891]	{445}
Lancaster	55,362	55,365	55,371	55,375	55,384	(11,077)	[2,658]	{1,329}	55,391	(11,078)	[2,659]	{1,329}	55,397	(11,079)	[2,659]	{1,330}
Lehigh	39,817	39,824	39,828	39,835	39,844	(7,969)	[1,913]	{956}	39,852	(7,970)	[1,913]	{956}	39,859	(7,972)	[1,913]	{957}
Luzerne	32,049	32,054	32,067	32,074	32,086	(6,417)	[1,540]	{770}	32,097	(6,419)	[1,541]	{770}	32,108	(6,422)	[1,541]	{771}
Monroe	14,802	14,805	14,808	14,810	14,817	(2,963)	[711]	{356}	14,823	(2,965)	[712]	{356}	14,829	(2,966)	[712]	{356}
Montgomery	70,360	70,369	70,368	70,368	70,382	(14,076)	[3,378]	{1,689}	70,393	(14,079)	[3,379]	{1,689}	70,404	(14,081)	[3,379]	{1,690}
Northampton	35,841	35,849	35,853	35,855	35,864	(7,173)	[1,721]	{861}	35,872	(7,174)	[1,722]	{861}	35,879	(7,176)	[1,722]	{861}
Philadelphia	154,261	154,286	154,286	154,286	154,329	(30,866)	[7,408]	{3,704}	154,368	(30,874)	[7,410]	{3,705}	154,402	(30,880)	[7,411]	{3,706}
Westmoreland	34,379	34,381	34,383	34,386	34,399	(6,880)	[1,651]	{826}	34,412	(6,882)	[1,652]	{826}	34,424	(6,885)	[1,652]	{826}
York	46,946	46,951	46,960	46,971	46,997	(9,399)	[2,256]	{1,128}	47,019	(9,404)	[2,257]	{1,128}	47,042	(9,408)	[2,258]	{1,129}

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.