

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

Date: 5/19/21

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 5/19/21 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.**

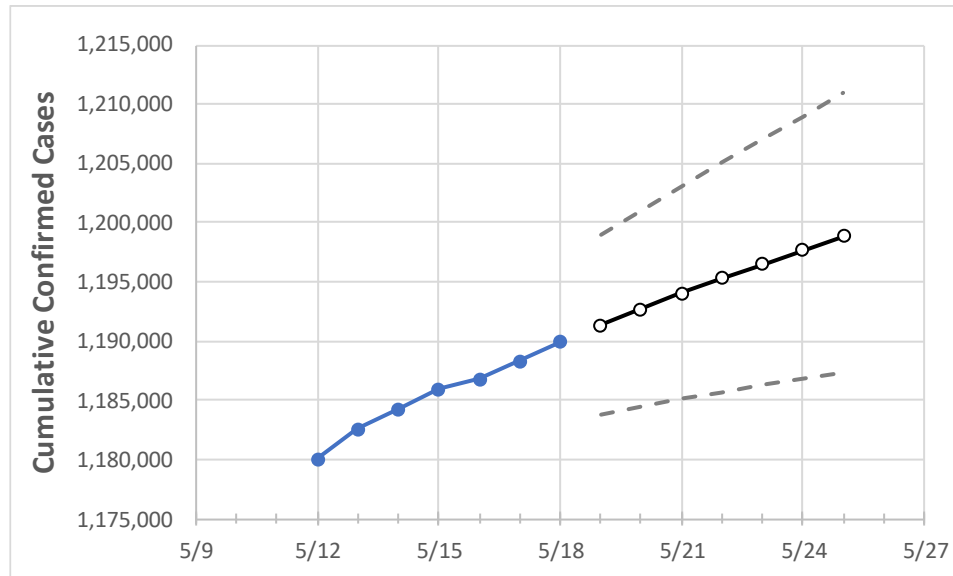
### IEM's Modeling Lead

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:							
5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	

Pennsylvania 1,185,952 1,186,798 1,188,272 1,189,913 1,191,353 1,192,702 1,194,039 1,195,287 1,196,521 1,197,699 1,198,832

*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:							
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	
Allegheny	100,039	100,130	100,201	100,367	100,486	100,601	100,709	100,816	100,920	101,019	101,115	
Berks	47,214	47,277	47,336	47,405	47,467	47,526	47,583	47,639	47,691	47,741	47,790	
Bucks	59,995	60,053	60,098	60,125	60,181	60,237	60,288	60,338	60,385	60,427	60,467	
Butler	17,207	17,214	17,230	17,258	17,276	17,295	17,312	17,329	17,346	17,362	17,378	
Chester	36,471	36,503	36,534	36,597	36,645	36,691	36,736	36,777	36,818	36,859	36,898	
Delaware	51,614	51,650	51,677	51,728	51,771	51,812	51,851	51,889	51,924	51,958	51,991	
Lackawanna	18,173	18,188	18,203	18,226	18,243	18,258	18,273	18,287	18,301	18,314	18,325	
Lancaster	54,528	54,577	54,601	54,662	54,716	54,765	54,814	54,860	54,905	54,946	54,987	
Lehigh	39,121	39,139	39,162	39,210	39,247	39,280	39,312	39,342	39,372	39,400	39,427	
Luzerne	31,286	31,307	31,335	31,387	31,427	31,466	31,503	31,541	31,576	31,609	31,641	
Monroe	14,491	14,511	14,532	14,551	14,573	14,594	14,614	14,633	14,651	14,667	14,684	
Montgomery	69,442	69,499	69,552	69,596	69,648	69,697	69,743	69,786	69,826	69,865	69,900	
Northampton	35,322	35,342	35,355	35,391	35,418	35,445	35,469	35,492	35,515	35,535	35,556	
Philadelphia	151,125	151,290	151,454	151,454	151,611	151,762	151,907	152,042	152,170	152,300	152,415	
Westmoreland	33,621	33,645	33,652	33,735	33,773	33,806	33,842	33,873	33,905	33,937	33,966	
York	45,567	45,610	45,654	45,741	45,797	45,851	45,901	45,950	45,998	46,042	46,085	

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:											
	5/15	5/16	5/17	5/18	5/20				5/22				5/24			
Allegheny	100,039	100,130	100,201	100,367	100,601	(20,120)	[4,829]	{2,414}	100,816	(20,163)	[4,839]	{2,420}	101,019	(20,204)	[4,849]	{2,424}
Berks	47,214	47,277	47,336	47,405	47,526	(9,505)	[2,281]	{1,141}	47,639	(9,528)	[2,287]	{1,143}	47,741	(9,548)	[2,292]	{1,146}
Bucks	59,995	60,053	60,098	60,125	60,237	(12,047)	[2,891]	{1,446}	60,338	(12,068)	[2,896]	{1,448}	60,427	(12,085)	[2,900]	{1,450}
Butler	17,207	17,214	17,230	17,258	17,295	(3,459)	[830]	{415}	17,329	(3,466)	[832]	{416}	17,362	(3,472)	[833]	{417}
Chester	36,471	36,503	36,534	36,597	36,691	(7,338)	[1,761]	{881}	36,777	(7,355)	[1,765]	{883}	36,859	(7,372)	[1,769]	{885}
Delaware	51,614	51,650	51,677	51,728	51,812	(10,362)	[2,487]	{1,243}	51,889	(10,378)	[2,491]	{1,245}	51,958	(10,392)	[2,494]	{1,247}
Lackawanna	18,173	18,188	18,203	18,226	18,258	(3,652)	[876]	{438}	18,287	(3,657)	[878]	{439}	18,314	(3,663)	[879]	{440}
Lancaster	54,528	54,577	54,601	54,662	54,765	(10,953)	[2,629]	{1,314}	54,860	(10,972)	[2,633]	{1,317}	54,946	(10,989)	[2,637]	{1,319}
Lehigh	39,121	39,139	39,162	39,210	39,280	(7,856)	[1,885]	{943}	39,342	(7,868)	[1,888]	{944}	39,400	(7,880)	[1,891]	{946}
Luzerne	31,286	31,307	31,335	31,387	31,466	(6,293)	[1,510]	{755}	31,541	(6,308)	[1,514]	{757}	31,609	(6,322)	[1,517]	{759}
Monroe	14,491	14,511	14,532	14,551	14,594	(2,919)	[701]	{350}	14,633	(2,927)	[702]	{351}	14,667	(2,933)	[704]	{352}
Montgomery	69,442	69,499	69,552	69,596	69,697	(13,939)	[3,345]	{1,673}	69,786	(13,957)	[3,350]	{1,675}	69,865	(13,973)	[3,354]	{1,677}
Northampton	35,322	35,342	35,355	35,391	35,445	(7,089)	[1,701]	{851}	35,492	(7,098)	[1,704]	{852}	35,535	(7,107)	[1,706]	{853}
Philadelphia	151,125	151,290	151,454	151,454	151,762	(30,352)	[7,285]	{3,642}	152,042	(30,408)	[7,298]	{3,649}	152,300	(30,460)	[7,310]	{3,655}
Westmoreland	33,621	33,645	33,652	33,735	33,806	(6,761)	[1,623]	{811}	33,873	(6,775)	[1,626]	{813}	33,937	(6,787)	[1,629]	{814}
York	45,567	45,610	45,654	45,741	45,851	(9,170)	[2,201]	{1,100}	45,950	(9,190)	[2,206]	{1,103}	46,042	(9,208)	[2,210]	{1,105}

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.