

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

**Date: 5/5/21**

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 5/5/21 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.**

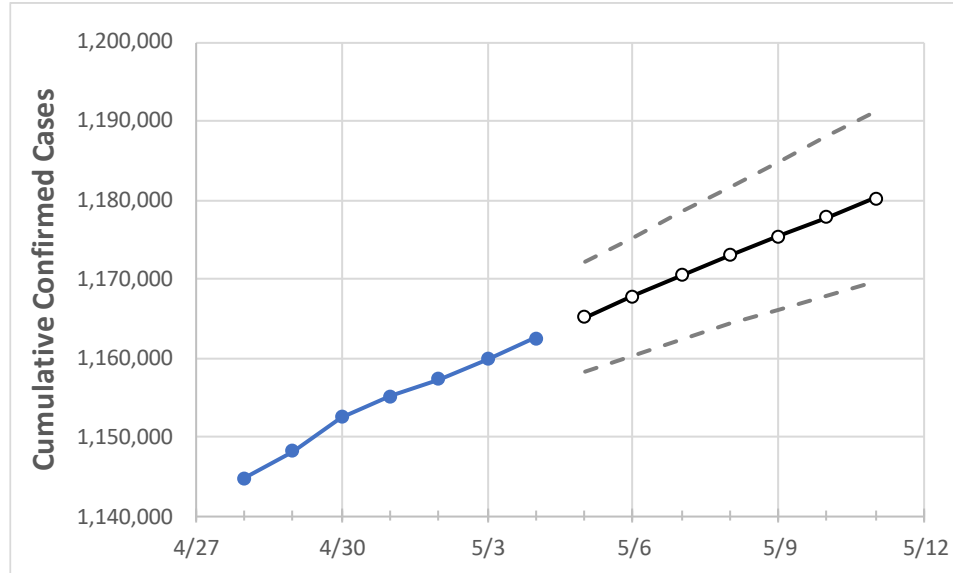
### **IEM's Modeling Lead**

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Pennsylvania	1,155,140	1,157,285	1,159,816	1,162,457	1,165,159	1,167,824	1,170,440	1,172,957	1,175,423	1,177,821	1,180,179

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Allegheny	97,521	97,760	97,975	98,197	98,395	98,593	98,777	98,957	99,131	99,302	99,462
Berks	45,758	45,835	45,865	46,102	46,243	46,387	46,527	46,672	46,804	46,941	47,074
Bucks	58,598	58,699	58,791	58,922	59,067	59,204	59,340	59,469	59,593	59,718	59,840
Butler	16,801	16,840	16,860	16,900	16,934	16,971	17,003	17,036	17,069	17,102	17,133
Chester	35,470	35,539	35,607	35,725	35,813	35,900	35,985	36,067	36,147	36,225	36,301
Delaware	50,582	50,680	50,743	50,814	50,909	51,001	51,093	51,178	51,259	51,339	51,418
Lackawanna	17,746	17,774	17,809	17,853	17,897	17,941	17,983	18,025	18,064	18,105	18,145
Lancaster	53,334	53,445	53,501	53,603	53,720	53,830	53,942	54,048	54,151	54,252	54,353
Lehigh	38,277	38,341	38,386	38,470	38,565	38,656	38,742	38,828	38,916	39,002	39,085
Luzerne	30,428	30,485	30,527	30,610	30,694	30,776	30,856	30,934	31,009	31,083	31,155
Monroe	13,970	14,009	14,038	14,094	14,151	14,207	14,263	14,317	14,372	14,427	14,479
Montgomery	68,000	68,153	68,241	68,399	68,556	68,707	68,862	69,009	69,150	69,292	69,427
Northampton	34,570	34,640	34,674	34,759	34,839	34,911	34,983	35,056	35,126	35,196	35,259
Philadelphia	147,427	147,729	148,031	148,031	148,377	148,719	149,050	149,371	149,684	149,981	150,276
Westmoreland	32,705	32,775	32,828	32,915	32,986	33,055	33,120	33,186	33,250	33,312	33,372
York	44,286	44,398	44,485	44,608	44,724	44,837	44,948	45,058	45,167	45,271	45,375

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:											
	5/1	5/2	5/3	5/4	5/6			5/8			5/10					
Allegheny	97,521	97,760	97,975	98,197	98,593	(19,719)	[4,732]	{2,366}	98,957	(19,791)	[4,750]	{2,375}	99,302	(19,860)	[4,766]	{2,383}
Berks	45,758	45,835	45,865	46,102	46,387	(9,277)	[2,227]	{1,113}	46,672	(9,334)	[2,240]	{1,120}	46,941	(9,388)	[2,253]	{1,127}
Bucks	58,598	58,699	58,791	58,922	59,204	(11,841)	[2,842]	{1,421}	59,469	(11,894)	[2,855]	{1,427}	59,718	(11,944)	[2,866]	{1,433}
Butler	16,801	16,840	16,860	16,900	16,971	(3,394)	[815]	{407}	17,036	(3,407)	[818]	{409}	17,102	(3,420)	[821]	{410}
Chester	35,470	35,539	35,607	35,725	35,900	(7,180)	[1,723]	{862}	36,067	(7,213)	[1,731]	{866}	36,225	(7,245)	[1,739]	{869}
Delaware	50,582	50,680	50,743	50,814	51,001	(10,200)	[2,448]	{1,224}	51,178	(10,236)	[2,457]	{1,228}	51,339	(10,268)	[2,464]	{1,232}
Lackawanna	17,746	17,774	17,809	17,853	17,941	(3,588)	[861]	{431}	18,025	(3,605)	[865]	{433}	18,105	(3,621)	[869]	{435}
Lancaster	53,334	53,445	53,501	53,603	53,830	(10,766)	[2,584]	{1,292}	54,048	(10,810)	[2,594]	{1,297}	54,252	(10,850)	[2,604]	{1,302}
Lehigh	38,277	38,341	38,386	38,470	38,656	(7,731)	[1,855]	{928}	38,828	(7,766)	[1,864]	{932}	39,002	(7,800)	[1,872]	{936}
Luzerne	30,428	30,485	30,527	30,610	30,776	(6,155)	[1,477]	{739}	30,934	(6,187)	[1,485]	{742}	31,083	(6,217)	[1,492]	{746}
Monroe	13,970	14,009	14,038	14,094	14,207	(2,841)	[682]	{341}	14,317	(2,863)	[687]	{344}	14,427	(2,885)	[693]	{346}
Montgomery	68,000	68,153	68,241	68,399	68,707	(13,741)	[3,298]	{1,649}	69,009	(13,802)	[3,312]	{1,656}	69,292	(13,858)	[3,326]	{1,663}
Northampton	34,570	34,640	34,674	34,759	34,911	(6,982)	[1,676]	{838}	35,056	(7,011)	[1,683]	{841}	35,196	(7,039)	[1,689]	{845}
Philadelphia	147,427	147,729	148,031	148,031	148,719	(29,744)	[7,138]	{3,569}	149,371	(29,874)	[7,170]	{3,585}	149,981	(29,996)	[7,199]	{3,600}
Westmoreland	32,705	32,775	32,828	32,915	33,055	(6,611)	[1,587]	{793}	33,186	(6,637)	[1,593]	{796}	33,312	(6,662)	[1,599]	{799}
York	44,286	44,398	44,485	44,608	44,837	(8,967)	[2,152]	{1,076}	45,058	(9,012)	[2,163]	{1,081}	45,271	(9,054)	[2,173]	{1,086}

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.