

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

**Date: 2/8/21**

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 2/8/21 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.**

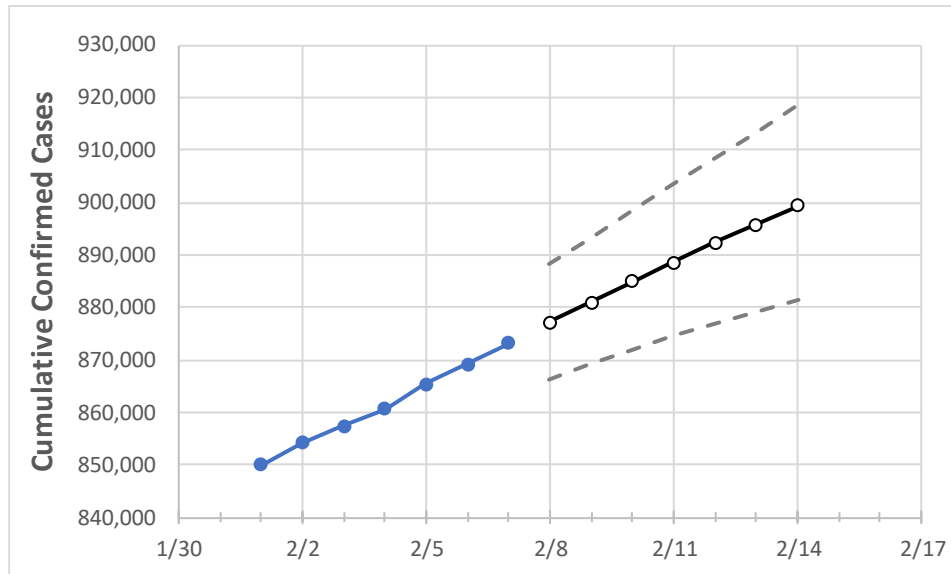
### **IEM's Modeling Lead**

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Pennsylvania	860,721	865,448	869,222	873,146	877,142	881,046	884,868	888,613	892,299	895,809	899,328

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Allegheny	70,478	70,813	71,083	71,343	71,600	71,848	72,088	72,329	72,562	72,787	73,009
Berks	33,104	33,202	33,364	33,530	33,711	33,887	34,060	34,225	34,385	34,539	34,686
Bucks	40,869	41,062	41,319	41,597	41,833	42,065	42,295	42,522	42,749	42,967	43,188
Butler	12,974	13,022	13,083	13,121	13,169	13,215	13,260	13,304	13,347	13,387	13,426
Chester	25,873	25,988	25,988	25,988	26,081	26,172	26,259	26,344	26,426	26,507	26,587
Delaware	37,868	37,983	38,137	38,324	38,463	38,598	38,728	38,853	38,977	39,097	39,212
Lackawanna	12,590	12,638	12,706	12,784	12,833	12,879	12,923	12,966	13,005	13,046	13,084
Lancaster	39,259	39,492	39,798	40,175	40,472	40,767	41,062	41,357	41,650	41,943	42,232
Lehigh	28,487	28,603	28,757	28,894	29,003	29,111	29,218	29,320	29,417	29,515	29,607
Luzerne	23,180	23,292	23,419	23,527	23,636	23,739	23,841	23,947	24,043	24,145	24,240
Monroe	8,736	8,765	8,813	8,875	8,916	8,953	8,991	9,028	9,064	9,097	9,132
Montgomery	49,475	49,635	49,877	50,217	50,491	50,752	51,018	51,279	51,530	51,783	52,029
Northampton	23,867	23,981	24,147	24,327	24,475	24,613	24,754	24,887	25,014	25,145	25,272
Philadelphia	111,411	111,750	111,750	111,750	112,098	112,433	112,763	113,094	113,414	113,727	114,040
Westmoreland	25,068	25,130	25,202	25,280	25,343	25,405	25,466	25,524	25,580	25,635	25,690
York	32,715	32,858	33,074	33,314	33,514	33,702	33,889	34,081	34,264	34,449	34,632

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:											
	2/4	2/5	2/6	2/7	2/9			2/11			2/13					
Allegheny	70,478	70,813	71,083	71,343	71,848	(14,370)	[3,449]	{1,724}	72,329	(14,466)	[3,472]	{1,736}	72,787	(14,557)	[3,494]	{1,747}
Berks	33,104	33,202	33,364	33,530	33,887	(6,777)	[1,627]	{813}	34,225	(6,845)	[1,643]	{821}	34,539	(6,908)	[1,658]	{829}
Bucks	40,869	41,062	41,319	41,597	42,065	(8,413)	[2,019]	{1,010}	42,522	(8,504)	[2,041]	{1,021}	42,967	(8,593)	[2,062]	{1,031}
Butler	12,974	13,022	13,083	13,121	13,215	(2,643)	[634]	{317}	13,304	(2,661)	[639]	{319}	13,387	(2,677)	[643]	{321}
Chester	25,873	25,988	25,988	25,988	26,172	(5,234)	[1,256]	{628}	26,344	(5,269)	[1,265]	{632}	26,507	(5,301)	[1,272]	{636}
Delaware	37,868	37,983	38,137	38,324	38,598	(7,720)	[1,853]	{926}	38,853	(7,771)	[1,865]	{932}	39,097	(7,819)	[1,877]	{938}
Lackawanna	12,590	12,638	12,706	12,784	12,879	(2,576)	[618]	{309}	12,966	(2,593)	[622]	{311}	13,046	(2,609)	[626]	{313}
Lancaster	39,259	39,492	39,798	40,175	40,767	(8,153)	[1,957]	{978}	41,357	(8,271)	[1,985]	{993}	41,943	(8,389)	[2,013]	{1,007}
Lehigh	28,487	28,603	28,757	28,894	29,111	(5,822)	[1,397]	{699}	29,320	(5,864)	[1,407]	{704}	29,515	(5,903)	[1,417]	{708}
Luzerne	23,180	23,292	23,419	23,527	23,739	(4,748)	[1,139]	{570}	23,947	(4,789)	[1,149]	{575}	24,145	(4,829)	[1,159]	{579}
Monroe	8,736	8,765	8,813	8,875	8,953	(1,791)	[430]	{215}	9,028	(1,806)	[433]	{217}	9,097	(1,819)	[437]	{218}
Montgomery	49,475	49,635	49,877	50,217	50,752	(10,150)	[2,436]	{1,218}	51,279	(10,256)	[2,461]	{1,231}	51,783	(10,357)	[2,486]	{1,243}
Northampton	23,867	23,981	24,147	24,327	24,613	(4,923)	[1,181]	{591}	24,887	(4,977)	[1,195]	{597}	25,145	(5,029)	[1,207]	{603}
Philadelphia	111,411	111,750	111,750	111,750	112,433	(22,487)	[5,397]	{2,698}	113,094	(22,619)	[5,429]	{2,714}	113,727	(22,745)	[5,459]	{2,729}
Westmoreland	25,068	25,130	25,202	25,280	25,405	(5,081)	[1,219]	{610}	25,524	(5,105)	[1,225]	{613}	25,635	(5,127)	[1,230]	{615}
York	32,715	32,858	33,074	33,314	33,702	(6,740)	[1,618]	{809}	34,081	(6,816)	[1,636]	{818}	34,449	(6,890)	[1,654]	{827}

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.