

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/11/21**

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 10/11/21 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.

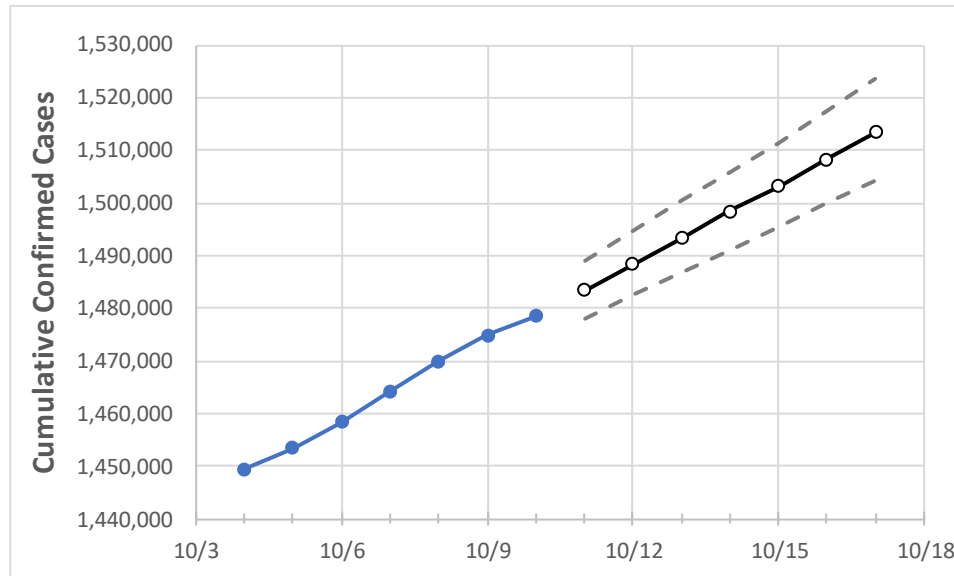
IEM's Modeling Lead

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Pennsylvania	1,464,264	1,469,847	1,474,822	1,478,421	1,483,336	1,488,374	1,493,250	1,498,333	1,503,149	1,508,326	1,513,372

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Allegheny	123,702	124,223	124,654	124,987	125,397	125,814	126,227	126,650	127,064	127,500	127,927
Berks	55,682	55,855	55,997	56,121	56,275	56,427	56,580	56,737	56,894	57,053	57,215
Bucks	70,266	70,417	70,612	70,783	70,962	71,141	71,320	71,506	71,693	71,884	72,075
Butler	23,268	23,364	23,519	23,628	23,755	23,884	24,014	24,145	24,276	24,409	24,541
Chester	48,461	48,574	48,574	48,574	48,707	48,841	48,973	49,107	49,241	49,377	49,513
Delaware	59,983	60,077	60,224	60,327	60,444	60,562	60,680	60,801	60,921	61,044	61,166
Lackawanna	21,616	21,694	21,767	21,835	21,903	21,973	22,041	22,112	22,182	22,257	22,327
Lancaster	67,266	67,564	67,825	68,057	68,301	68,553	68,805	69,056	69,310	69,571	69,825
Lehigh	46,741	46,883	46,980	47,044	47,138	47,236	47,326	47,422	47,515	47,612	47,707
Luzerne	38,284	38,441	38,610	38,739	38,901	39,065	39,233	39,404	39,576	39,757	39,932
Monroe	18,566	18,663	18,727	18,790	18,852	18,914	18,975	19,037	19,098	19,161	19,221
Montgomery	81,997	82,184	82,342	82,527	82,709	82,891	83,077	83,263	83,448	83,641	83,827
Northampton	42,818	42,961	43,050	43,098	43,194	43,295	43,390	43,488	43,585	43,686	43,779
Philadelphia	176,497	176,753	176,753	176,753	177,054	177,349	177,634	177,927	178,226	178,526	178,823
Westmoreland	41,900	42,095	42,260	42,361	42,521	42,683	42,846	43,008	43,166	43,339	43,507
York	57,821	58,042	58,300	58,479	58,704	58,932	59,156	59,387	59,618	59,847	60,085

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:											
	10/7	10/8	10/9	10/10	10/12			10/14			10/16					
Allegheny	123,702	124,223	124,654	124,987	125,814	(25,163)	[6,039]	{3,020}	126,650	(25,330)	[6,079]	{3,040}	127,500	(25,500)	[6,120]	{3,060}
Berks	55,682	55,855	55,997	56,121	56,427	(11,285)	[2,708]	{1,354}	56,737	(11,347)	[2,723]	{1,362}	57,053	(11,411)	[2,739]	{1,369}
Bucks	70,266	70,417	70,612	70,783	71,141	(14,228)	[3,415]	{1,707}	71,506	(14,301)	[3,432]	{1,716}	71,884	(14,377)	[3,450]	{1,725}
Butler	23,268	23,364	23,519	23,628	23,884	(4,777)	[1,146]	{573}	24,145	(4,829)	[1,159]	{579}	24,409	(4,882)	[1,172]	{586}
Chester	48,461	48,574	48,574	48,574	48,841	(9,768)	[2,344]	{1,172}	49,107	(9,821)	[2,357]	{1,179}	49,377	(9,875)	[2,370]	{1,185}
Delaware	59,983	60,077	60,224	60,327	60,562	(12,112)	[2,907]	{1,453}	60,801	(12,160)	[2,918]	{1,459}	61,044	(12,209)	[2,930]	{1,465}
Lackawanna	21,616	21,694	21,767	21,835	21,973	(4,395)	[1,055]	{527}	22,112	(4,422)	[1,061]	{531}	22,257	(4,451)	[1,068]	{534}
Lancaster	67,266	67,564	67,825	68,057	68,553	(13,711)	[3,291]	{1,645}	69,056	(13,811)	[3,315]	{1,657}	69,571	(13,914)	[3,339]	{1,670}
Lehigh	46,741	46,883	46,980	47,044	47,236	(9,447)	[2,267]	{1,134}	47,422	(9,484)	[2,276]	{1,138}	47,612	(9,522)	[2,285]	{1,143}
Luzerne	38,284	38,441	38,610	38,739	39,065	(7,813)	[1,875]	{938}	39,404	(7,881)	[1,891]	{946}	39,757	(7,951)	[1,908]	{954}
Monroe	18,566	18,663	18,727	18,790	18,914	(3,783)	[908]	{454}	19,037	(3,807)	[914]	{457}	19,161	(3,832)	[920]	{460}
Montgomery	81,997	82,184	82,342	82,527	82,891	(16,578)	[3,979]	{1,989}	83,263	(16,653)	[3,997]	{1,998}	83,641	(16,728)	[4,015]	{2,007}
Northampton	42,818	42,961	43,050	43,098	43,295	(8,659)	[2,078]	{1,039}	43,488	(8,698)	[2,087]	{1,044}	43,686	(8,737)	[2,097]	{1,048}
Philadelphia	176,497	176,753	176,753	176,753	177,349	(35,470)	[8,513]	{4,256}	177,927	(35,585)	[8,541]	{4,270}	178,526	(35,705)	[8,569]	{4,285}
Westmoreland	41,900	42,095	42,260	42,361	42,683	(8,537)	[2,049]	{1,024}	43,008	(8,602)	[2,064]	{1,032}	43,339	(8,668)	[2,080]	{1,040}
York	57,821	58,042	58,300	58,479	58,932	(11,786)	[2,829]	{1,414}	59,387	(11,877)	[2,851]	{1,425}	59,847	(11,969)	[2,873]	{1,436}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.