

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/6/21**

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 10/6/21 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.

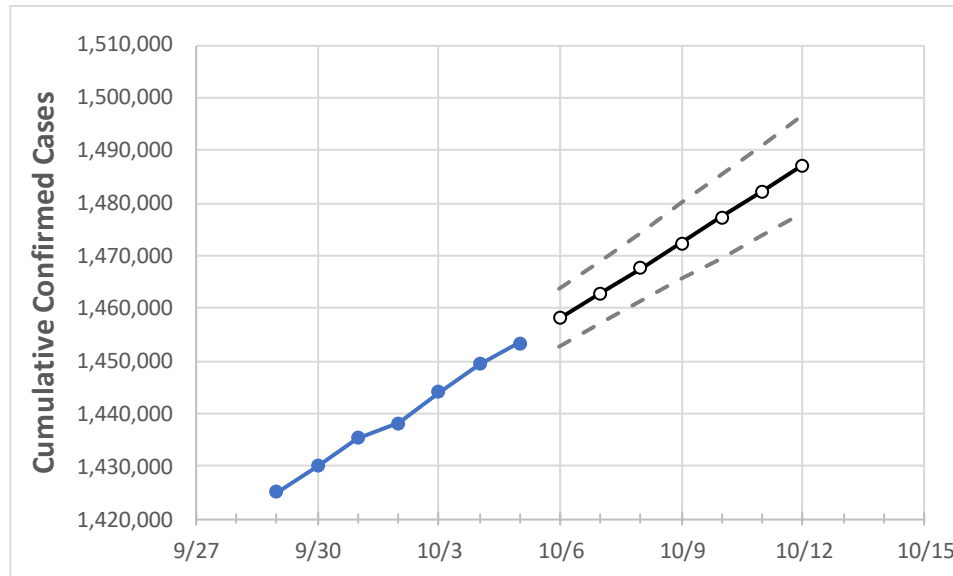
IEM's Modeling Lead

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:							
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	
Pennsylvania	1,438,179	1,444,053	1,449,368	1,453,387	1,458,186	1,462,917	1,467,672	1,472,431	1,477,376	1,482,268	1,487,142	

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Allegheny	121,604	122,150	122,497	122,693	123,057	123,414	123,760	124,118	124,479	124,829	125,188
Berks	54,921	55,072	55,288	55,421	55,574	55,728	55,886	56,045	56,206	56,370	56,534
Bucks	69,330	69,502	69,730	69,908	70,071	70,243	70,411	70,579	70,755	70,928	71,101
Butler	22,621	22,818	22,919	22,981	23,107	23,231	23,352	23,480	23,609	23,736	23,865
Chester	47,785	47,929	48,073	48,201	48,341	48,484	48,629	48,775	48,924	49,074	49,224
Delaware	59,376	59,477	59,569	59,637	59,737	59,835	59,933	60,031	60,132	60,230	60,329
Lackawanna	21,278	21,362	21,443	21,485	21,550	21,617	21,684	21,752	21,818	21,889	21,956
Lancaster	66,030	66,364	66,614	66,785	67,012	67,237	67,464	67,691	67,916	68,149	68,380
Lehigh	46,176	46,321	46,432	46,519	46,609	46,699	46,786	46,872	46,958	47,048	47,133
Luzerne	37,449	37,685	37,848	37,948	38,098	38,261	38,416	38,580	38,744	38,913	39,085
Monroe	18,283	18,350	18,401	18,447	18,504	18,560	18,617	18,672	18,728	18,784	18,837
Montgomery	81,012	81,195	81,411	81,632	81,808	81,988	82,167	82,346	82,526	82,706	82,889
Northampton	42,266	42,417	42,552	42,640	42,749	42,852	42,957	43,065	43,172	43,279	43,385
Philadelphia	175,069	175,277	175,486	175,804	176,081	176,358	176,625	176,907	177,174	177,457	177,734
Westmoreland	41,105	41,306	41,427	41,513	41,658	41,813	41,960	42,103	42,258	42,409	42,559
York	56,603	56,925	57,192	57,361	57,586	57,806	58,034	58,259	58,489	58,719	58,952

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:											
	10/2	10/3	10/4	10/5	10/7				10/9				10/11			
Allegheny	121,604	122,150	122,497	122,693	123,414	(24,683)	[5,924]	{2,962}	124,118	(24,824)	[5,958]	{2,979}	124,829	(24,966)	[5,992]	{2,996}
Berks	54,921	55,072	55,288	55,421	55,728	(11,146)	[2,675]	{1,337}	56,045	(11,209)	[2,690]	{1,345}	56,370	(11,274)	[2,706]	{1,353}
Bucks	69,330	69,502	69,730	69,908	70,243	(14,049)	[3,372]	{1,686}	70,579	(14,116)	[3,388]	{1,694}	70,928	(14,186)	[3,405]	{1,702}
Butler	22,621	22,818	22,919	22,981	23,231	(4,646)	[1,115]	{558}	23,480	(4,696)	[1,127]	{564}	23,736	(4,747)	[1,139]	{570}
Chester	47,785	47,929	48,073	48,201	48,484	(9,697)	[2,327]	{1,164}	48,775	(9,755)	[2,341]	{1,171}	49,074	(9,815)	[2,356]	{1,178}
Delaware	59,376	59,477	59,569	59,637	59,835	(11,967)	[2,872]	{1,436}	60,031	(12,006)	[2,882]	{1,441}	60,230	(12,046)	[2,891]	{1,446}
Lackawanna	21,278	21,362	21,443	21,485	21,617	(4,323)	[1,038]	{519}	21,752	(4,350)	[1,044]	{522}	21,889	(4,378)	[1,051]	{525}
Lancaster	66,030	66,364	66,614	66,785	67,237	(13,447)	[3,227]	{1,614}	67,691	(13,538)	[3,249]	{1,625}	68,149	(13,630)	[3,271]	{1,636}
Lehigh	46,176	46,321	46,432	46,519	46,699	(9,340)	[2,242]	{1,121}	46,872	(9,374)	[2,250]	{1,125}	47,048	(9,410)	[2,258]	{1,129}
Luzerne	37,449	37,685	37,848	37,948	38,261	(7,652)	[1,837]	{918}	38,580	(7,716)	[1,852]	{926}	38,913	(7,783)	[1,868]	{934}
Monroe	18,283	18,350	18,401	18,447	18,560	(3,712)	[891]	{445}	18,672	(3,734)	[896]	{448}	18,784	(3,757)	[902]	{451}
Montgomery	81,012	81,195	81,411	81,632	81,988	(16,398)	[3,935]	{1,968}	82,346	(16,469)	[3,953]	{1,976}	82,706	(16,541)	[3,970]	{1,985}
Northampton	42,266	42,417	42,552	42,640	42,852	(8,570)	[2,057]	{1,028}	43,065	(8,613)	[2,067]	{1,034}	43,279	(8,656)	[2,077]	{1,039}
Philadelphia	175,069	175,277	175,486	175,804	176,358	(35,272)	[8,465]	{4,233}	176,907	(35,381)	[8,492]	{4,246}	177,457	(35,491)	[8,518]	{4,259}
Westmoreland	41,105	41,306	41,427	41,513	41,813	(8,363)	[2,007]	{1,004}	42,103	(8,421)	[2,021]	{1,010}	42,409	(8,482)	[2,036]	{1,018}
York	56,603	56,925	57,192	57,361	57,806	(11,561)	[2,775]	{1,387}	58,259	(11,652)	[2,796]	{1,398}	58,719	(11,744)	[2,819]	{1,409}

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.