

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

Date: 8/9/21

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 8/9/21 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.

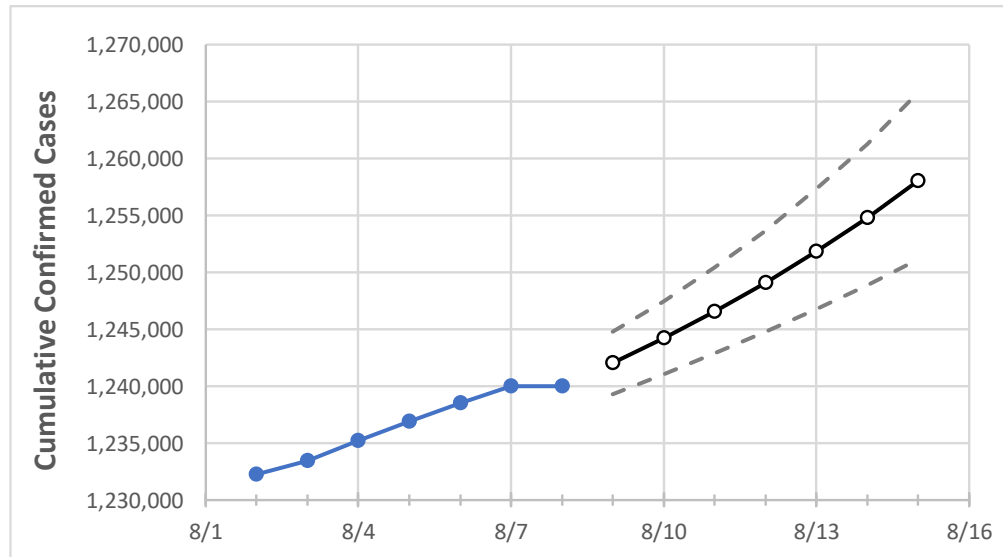
IEM's Modeling Lead

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
Pennsylvania	1,236,887	1,238,552	1,239,996	1,239,996	1,242,040	1,244,218	1,246,573	1,249,120	1,251,832	1,254,820	1,258,042

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:							
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	
Allegheny	103,866	104,042	104,185	104,185	104,407	104,650	104,911	105,193	105,508	105,858	106,239	
Berks	49,017	49,067	49,128	49,128	49,187	49,249	49,318	49,391	49,469	49,553	49,644	
Bucks	61,917	61,992	62,105	62,105	62,201	62,305	62,415	62,533	62,657	62,790	62,930	
Butler	17,906	17,944	17,964	17,964	17,997	18,034	18,074	18,119	18,168	18,222	18,280	
Chester	41,541	41,610	41,610	41,610	41,685	41,766	41,854	41,950	42,054	42,171	42,293	
Delaware	53,292	53,366	53,453	53,453	53,548	53,651	53,761	53,878	54,004	54,140	54,285	
Lackawanna	18,812	18,826	18,851	18,851	18,877	18,905	18,937	18,970	19,006	19,046	19,088	
Lancaster	56,306	56,380	56,482	56,482	56,595	56,718	56,853	57,001	57,162	57,336	57,530	
Lehigh	40,485	40,551	40,620	40,620	40,699	40,785	40,879	40,984	41,099	41,224	41,362	
Luzerne	32,629	32,690	32,730	32,730	32,794	32,865	32,941	33,026	33,119	33,218	33,329	
Monroe	15,203	15,234	15,275	15,275	15,306	15,339	15,375	15,412	15,451	15,493	15,539	
Montgomery	71,880	71,983	72,101	72,101	72,240	72,386	72,541	72,707	72,884	73,075	73,273	
Northampton	36,657	36,725	36,806	36,806	36,901	37,004	37,116	37,238	37,374	37,523	37,683	
Philadelphia	157,951	158,129	158,129	158,129	158,382	158,652	158,939	159,237	159,558	159,900	160,262	
Westmoreland	34,886	34,938	34,957	34,957	35,001	35,048	35,098	35,152	35,210	35,273	35,339	
York	47,724	47,785	47,847	47,847	47,921	48,000	48,086	48,181	48,283	48,394	48,515	

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:											
	8/5	8/6	8/7	8/8	8/10				8/12				8/14			
Allegheny	103,866	104,042	104,185	104,185	104,650	(20,930)	[5,023]	{2,512}	105,193	(21,039)	[5,049]	{2,525}	105,858	(21,172)	[5,081]	{2,541}
Berks	49,017	49,067	49,128	49,128	49,249	(9,850)	[2,364]	{1,182}	49,391	(9,878)	[2,371]	{1,185}	49,553	(9,911)	[2,379]	{1,189}
Bucks	61,917	61,992	62,105	62,105	62,305	(12,461)	[2,991]	{1,495}	62,533	(12,507)	[3,002]	{1,501}	62,790	(12,558)	[3,014]	{1,507}
Butler	17,906	17,944	17,964	17,964	18,034	(3,607)	[866]	{433}	18,119	(3,624)	[870]	{435}	18,222	(3,644)	[875]	{437}
Chester	41,541	41,610	41,610	41,610	41,766	(8,353)	[2,005]	{1,002}	41,950	(8,390)	[2,014]	{1,007}	42,171	(8,434)	[2,024]	{1,012}
Delaware	53,292	53,366	53,453	53,453	53,651	(10,730)	[2,575]	{1,288}	53,878	(10,776)	[2,586]	{1,293}	54,140	(10,828)	[2,599]	{1,299}
Lackawanna	18,812	18,826	18,851	18,851	18,905	(3,781)	[907]	{454}	18,970	(3,794)	[911]	{455}	19,046	(3,809)	[914]	{457}
Lancaster	56,306	56,380	56,482	56,482	56,718	(11,344)	[2,722]	{1,361}	57,001	(11,400)	[2,736]	{1,368}	57,336	(11,467)	[2,752]	{1,376}
Lehigh	40,485	40,551	40,620	40,620	40,785	(8,157)	[1,958]	{979}	40,984	(8,197)	[1,967]	{984}	41,224	(8,245)	[1,979]	{989}
Luzerne	32,629	32,690	32,730	32,730	32,865	(6,573)	[1,578]	{789}	33,026	(6,605)	[1,585]	{793}	33,218	(6,644)	[1,594]	{797}
Monroe	15,203	15,234	15,275	15,275	15,339	(3,068)	[736]	{368}	15,412	(3,082)	[740]	{370}	15,493	(3,099)	[744]	{372}
Montgomery	71,880	71,983	72,101	72,101	72,386	(14,477)	[3,475]	{1,737}	72,707	(14,541)	[3,490]	{1,745}	73,075	(14,615)	[3,508]	{1,754}
Northampton	36,657	36,725	36,806	36,806	37,004	(7,401)	[1,776]	{888}	37,238	(7,448)	[1,787]	{894}	37,523	(7,505)	[1,801]	{901}
Philadelphia	157,951	158,129	158,129	158,129	158,652	(31,730)	[7,615]	{3,808}	159,237	(31,847)	[7,643]	{3,822}	159,900	(31,980)	[7,675]	{3,838}
Westmoreland	34,886	34,938	34,957	34,957	35,048	(7,010)	[1,682]	{841}	35,152	(7,030)	[1,687]	{844}	35,273	(7,055)	[1,693]	{847}
York	47,724	47,785	47,847	47,847	48,000	(9,600)	[2,304]	{1,152}	48,181	(9,636)	[2,313]	{1,156}	48,394	(9,679)	[2,323]	{1,161}

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.