

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

Date: 6/8/21

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 6/8/21 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.

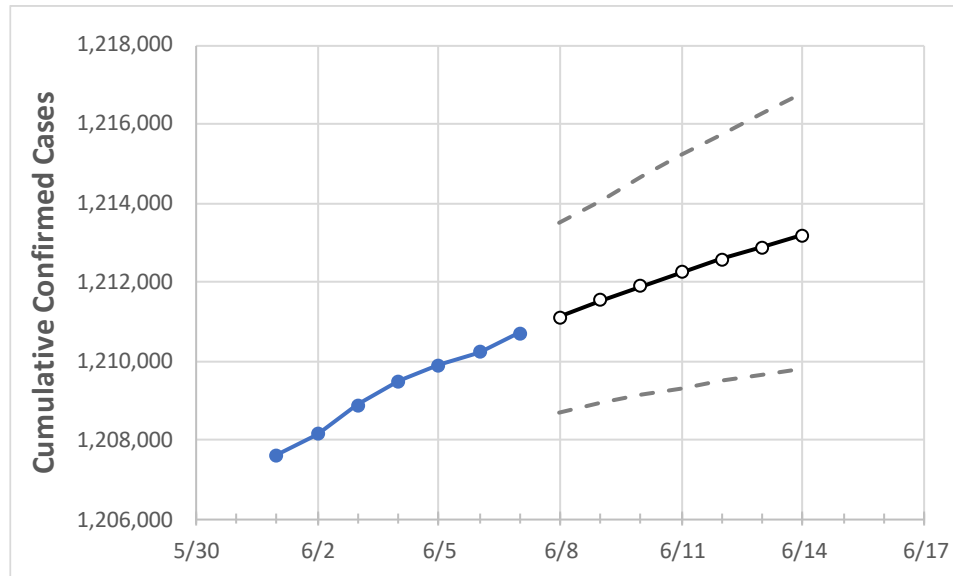
IEM's Modeling Lead

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:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Pennsylvania	1,209,492	1,209,894	1,210,224	1,210,691	1,211,111	1,211,526	1,211,900	1,212,244	1,212,579	1,212,887	1,213,182

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:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Allegheny	101,446	101,471	101,492	101,522	101,546	101,568	101,589	101,608	101,627	101,644	101,659
Berks	48,101	48,118	48,135	48,147	48,164	48,181	48,197	48,211	48,225	48,238	48,250
Bucks	60,640	60,652	60,667	60,682	60,692	60,700	60,708	60,716	60,723	60,730	60,736
Butler	17,515	17,518	17,523	17,529	17,537	17,545	17,552	17,559	17,566	17,572	17,578
Chester	40,698	40,699	40,699	40,700	40,706	40,711	40,716	40,720	40,724	40,727	40,730
Delaware	52,210	52,247	52,255	52,269	52,282	52,295	52,307	52,318	52,328	52,338	52,347
Lackawanna	18,461	18,465	18,472	18,475	18,481	18,486	18,491	18,496	18,500	18,504	18,508
Lancaster	55,206	55,216	55,236	55,249	55,262	55,275	55,287	55,298	55,309	55,319	55,329
Lehigh	39,674	39,689	39,699	39,710	39,720	39,729	39,737	39,745	39,753	39,760	39,767
Luzerne	31,886	31,900	31,908	31,918	31,929	31,940	31,949	31,958	31,968	31,976	31,984
Monroe	14,718	14,723	14,729	14,731	14,735	14,738	14,741	14,744	14,746	14,749	14,751
Montgomery	70,163	70,189	70,201	70,219	70,237	70,254	70,270	70,287	70,301	70,315	70,328
Northampton	35,722	35,728	35,734	35,742	35,748	35,752	35,757	35,761	35,765	35,769	35,772
Philadelphia	153,572	153,623	153,673	153,724	153,775	153,824	153,870	153,914	153,955	153,994	154,031
Westmoreland	34,191	34,204	34,221	34,228	34,239	34,250	34,260	34,269	34,278	34,286	34,294
York	46,516	46,537	46,554	46,573	46,597	46,620	46,641	46,663	46,684	46,702	46,720

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:											
	6/4	6/5	6/6	6/7	6/9			6/11			6/13					
Allegheny	101,446	101,471	101,492	101,522	101,568	(20,314)	[4,875]	{2,438}	101,608	(20,322)	[4,877]	{2,439}	101,644	(20,329)	[4,879]	{2,439}
Berks	48,101	48,118	48,135	48,147	48,181	(9,636)	[2,313]	{1,156}	48,211	(9,642)	[2,314]	{1,157}	48,238	(9,648)	[2,315]	{1,158}
Bucks	60,640	60,652	60,667	60,682	60,700	(12,140)	[2,914]	{1,457}	60,716	(12,143)	[2,914]	{1,457}	60,730	(12,146)	[2,915]	{1,458}
Butler	17,515	17,518	17,523	17,529	17,545	(3,509)	[842]	{421}	17,559	(3,512)	[843]	{421}	17,572	(3,514)	[843]	{422}
Chester	40,698	40,699	40,699	40,700	40,711	(8,142)	[1,954]	{977}	40,720	(8,144)	[1,955]	{977}	40,727	(8,145)	[1,955]	{977}
Delaware	52,210	52,247	52,255	52,269	52,295	(10,459)	[2,510]	{1,255}	52,318	(10,464)	[2,511]	{1,256}	52,338	(10,468)	[2,512]	{1,256}
Lackawanna	18,461	18,465	18,472	18,475	18,486	(3,697)	[887]	{444}	18,496	(3,699)	[888]	{444}	18,504	(3,701)	[888]	{444}
Lancaster	55,206	55,216	55,236	55,249	55,275	(11,055)	[2,653]	{1,327}	55,298	(11,060)	[2,654]	{1,327}	55,319	(11,064)	[2,655]	{1,328}
Lehigh	39,674	39,689	39,699	39,710	39,729	(7,946)	[1,907]	{953}	39,745	(7,949)	[1,908]	{954}	39,760	(7,952)	[1,908]	{954}
Luzerne	31,886	31,900	31,908	31,918	31,940	(6,388)	[1,533]	{767}	31,958	(6,392)	[1,534]	{767}	31,976	(6,395)	[1,535]	{767}
Monroe	14,718	14,723	14,729	14,731	14,738	(2,948)	[707]	{354}	14,744	(2,949)	[708]	{354}	14,749	(2,950)	[708]	{354}
Montgomery	70,163	70,189	70,201	70,219	70,254	(14,051)	[3,372]	{1,686}	70,287	(14,057)	[3,374]	{1,687}	70,315	(14,063)	[3,375]	{1,688}
Northampton	35,722	35,728	35,734	35,742	35,752	(7,150)	[1,716]	{858}	35,761	(7,152)	[1,717]	{858}	35,769	(7,154)	[1,717]	{858}
Philadelphia	153,572	153,623	153,673	153,724	153,824	(30,765)	[7,384]	{3,692}	153,914	(30,783)	[7,388]	{3,694}	153,994	(30,799)	[7,392]	{3,696}
Westmoreland	34,191	34,204	34,221	34,228	34,250	(6,850)	[1,644]	{822}	34,269	(6,854)	[1,645]	{822}	34,286	(6,857)	[1,646]	{823}
York	46,516	46,537	46,554	46,573	46,620	(9,324)	[2,238]	{1,119}	46,663	(9,333)	[2,240]	{1,120}	46,702	(9,340)	[2,242]	{1,121}

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.